# Grand Rounds Presentation

An Unusual Case of Pneumonia

Dr. Luke Wu, M.D., M.Sc., FRCPC IM

# Learning Objectives

1. Review diagnosis of community acquired pneumonia, severity risk assessment, and management strategies based on severity.
2. Differentiate between causes of non-resolving pneumonia, including infectious, inflammatory, neoplastic, drug induced, and pulmonary vascular etiologies.
3. Recognize the clinical, radiologic, and laboratory features that help identify non-resolving pneumonias.
4. Describe the indications, contraindications, diagnostic yield and test findings in bronchoscopy and BAL in the work-up of non-resolving pneumonias
5. Apply a stepwise diagnostic framework for evaluating patients with non-resolving pneumonia, including optimal timing for advanced imaging, microbiologic testing, and consultation.

# Case overview

## HPI:

53y M presented to PCP in September for fevers, dyspnea, and productive cough.

Also c/o chest tightness, general malaise, and headache. Also reporting weight loss.

No hemopytsis, orthopena, PND, LE edema, night sweats, abdominal pain, altered bowel movements, skin rashes.


## PMH:

Non-ischemic cardiomyopathy. Followed by Cardiology. Recent echocardiogram showed recovered LVEF.

Hypertension.

Dyslipidemia.

Type 2 diabetes mellitus with a baseline A1c of 6.8%.

Bilateral trigger thumb.

## Meds:

Bisoprolol 2.5 mg daily.

Rosuvastatin 20 mg daily.

Metformin 1 g p.o. b.i.d.

Jardiance 25 mg daily.

Ventolin 2 puffs q.4 hours p.r.n.

## Social / exposures:

Lives at home with wife and daughter in Barrie.

Non-smoker, minimal ETOH.

No sick contacts, no recent travel

Works in automotive plant with engine oil, does not note exposure to brake dust, aerosolized chemicals.

Has a pet dog and cat, no new animal exposures

No hx of living on indigenous reserve, incarceration, travel to TB endemic areas.

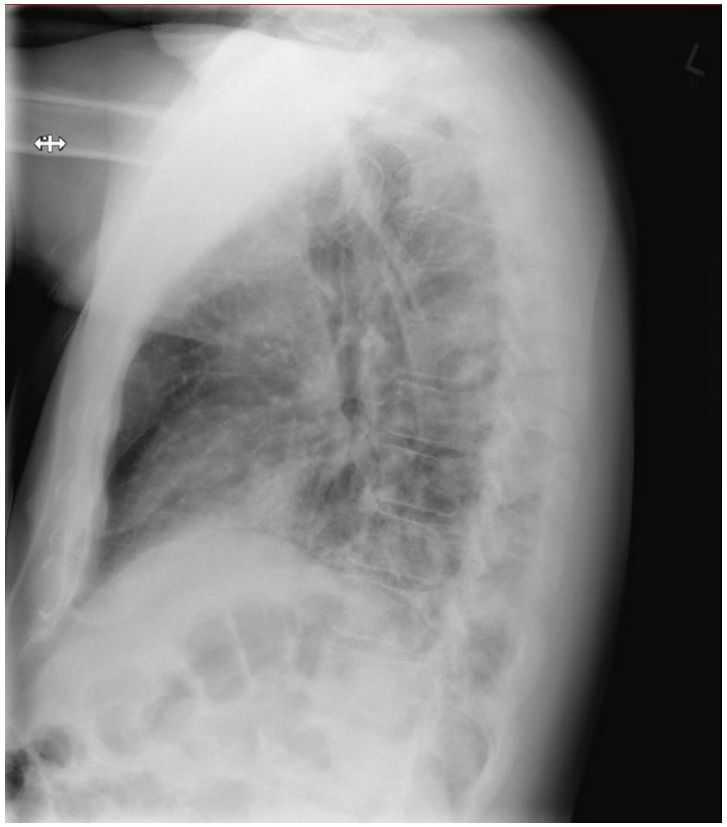
No recent pillow changes.

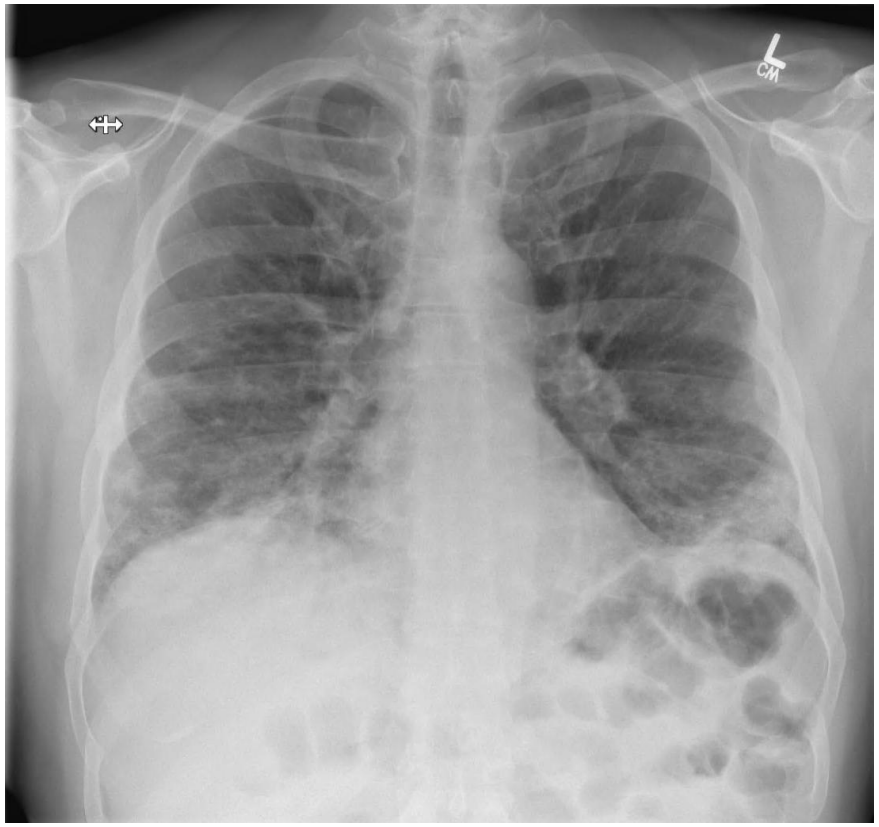
# Case overview continued

PCP presumed pts presentation was community acquired pneumonia and was treated with clarithromycin 500mg PO BID

Pt continued to worsen with ongoing respiratory symptoms and fever over several days and presented to RVH on 09/24/2025.

Found to be hypoxic (~88% on RA) and mild tachypnea (RR 22) and afebrile with T 36.3.





# CXR @ RVH (09/24/2025)

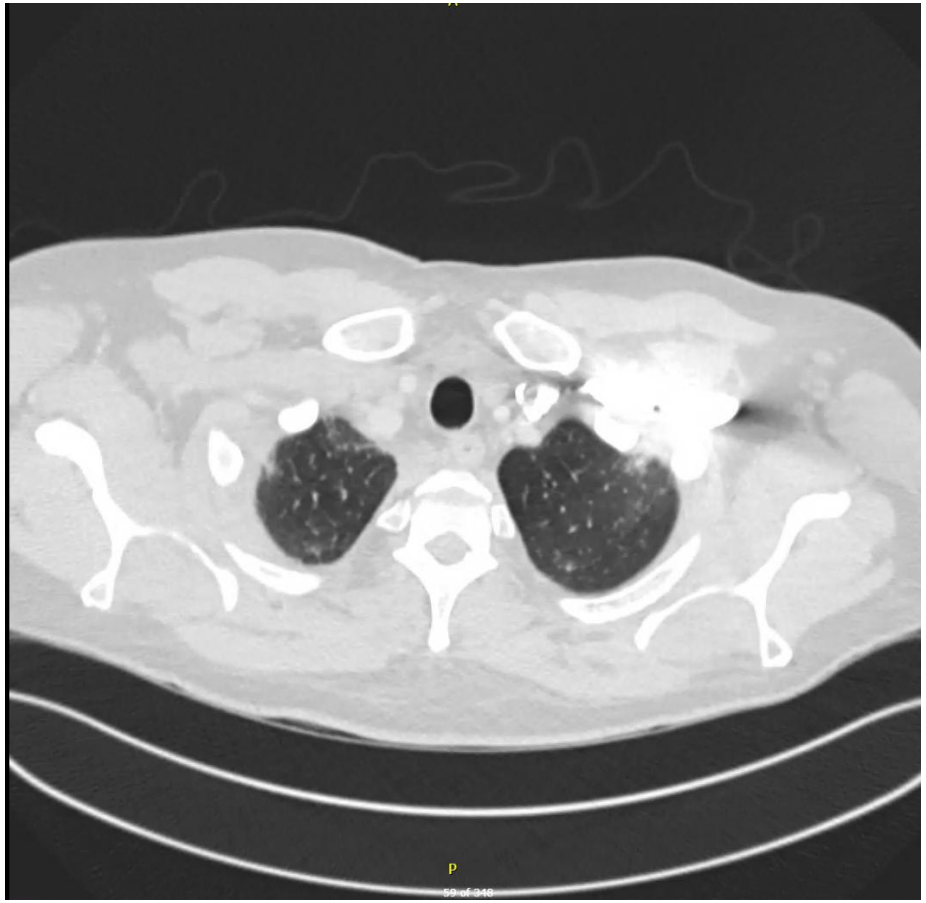
# Case overview continued

Admitted for CAP at RVH and treated with Moxifloxacin X 5 days.

Ongoing hypoxia requiring 1-2lpm O2 throughout hospital course.
Borderline fever T ~38 at admission, but no recurrence after.

Thought to be volume overloaded and trial of Lasix (unclear dose) for a few days, without improvement.

Underwent CTPE 09/27/2025




Pulmonary Arteries: No definite filling defect identified in the pulmonary arterial tree along for late contrast timing.

Tracheobronchial Tree: Patent.

Lung Parenchyma: There are patchy multifocal peripheral airspace opacities most pronounced at the lung bases with coursing air bronchograms. This is most in keeping with pneumonia. No cavitary changes. No evidence of a pulmonary abscess.

Pleural Spaces: Normal.

Lymph Nodes: Small reactive appearing lymphadenopathy in the hila and mediastinum.

Mediastinum: The esophagus is unremarkable. No mediastinal hematoma or pneumomediastinum.

Heart and Pericardium: Normal.

Base of the Neck: Unremarkable.

Upper Abdomen: No acute abnormality in the visualized upper abdomen.

Bones and Soft Tissues: No aggressive osseous lesion or concerning soft tissue abnormality.

IMPRESSION:

1. Technically suboptimal pulmonary angiogram with no definite embolism identified.

2. Extensive bilateral pneumonia as evident on recent chest radiographs.

# CTPE @ RVH (09/27/2025)

# Case overview continued

D/c'd home on home O2 (1-2lpm) on 09/30/2025 with plan for repeat CT chest in 2-3 weeks and follow up in IM clinic.

Went to live with brother in Muskoka after discharge for assistance with recovery.

Several days after discharge, Noticed increasing dyspnea and cough with productive sputum. Dyspnea bad especially while sitting up and pt reporting requiring up to 6lpm O2. Also new right arm swelling.

Presented to SMMH 10/05/2025

# SMMH Emergency department: H&P + Exam

Went to cottage in Bracebridge this week to recover. Has not found any improvement in dyspnea. Continued to have ongoing productive cough, feeling weak and short of breath. Presents to hospital today as now has new right arm swelling.
On review of systems: notes 20 lb weight loss in the month proceeding presentation as already had started to feel unwell with decreased oral intake. Notes no obvious lymphadenopathy, does endorse some tarry stool during admission due to medications given with diarrhea, although notes this starts to be improving. Ongoing low grade fevers at home, poor appetite, feeling unwell.

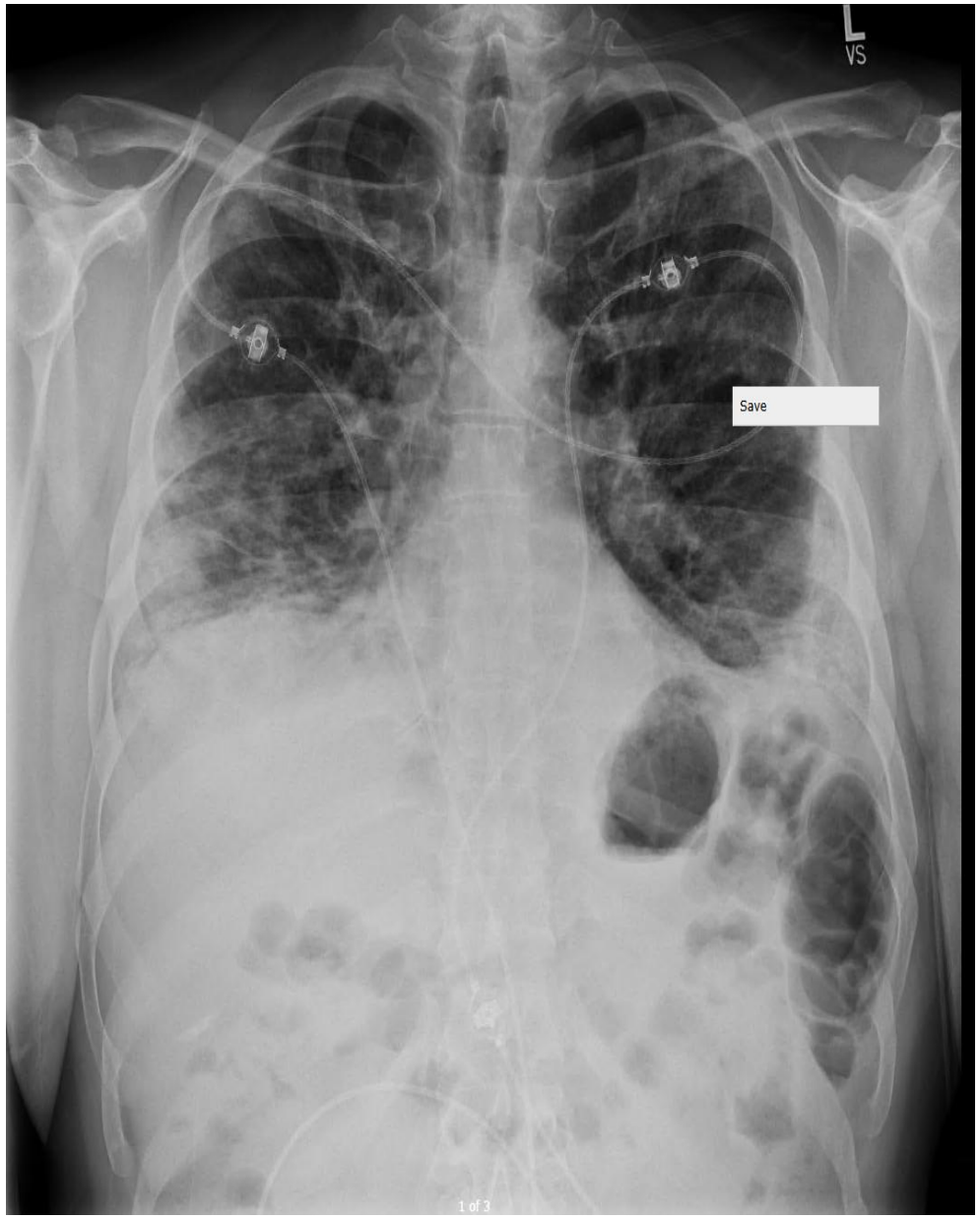
On Examination:
36.5C. C. HR 84, BP 127/82, RR 20, SpOw3 96% 2L NP
Alert and oriented x 3
Mild increased wob with talking but otherwise not in extremis
CVS NS1S2 -EHS
Abdo soft nontender
No LE edema
Rt arm edematous. Neurovascularly intact. No signs of superimposed cellulitis.
No cervical or supraclavicular lymphadenopathy

# SMMH Emergency department: Labs

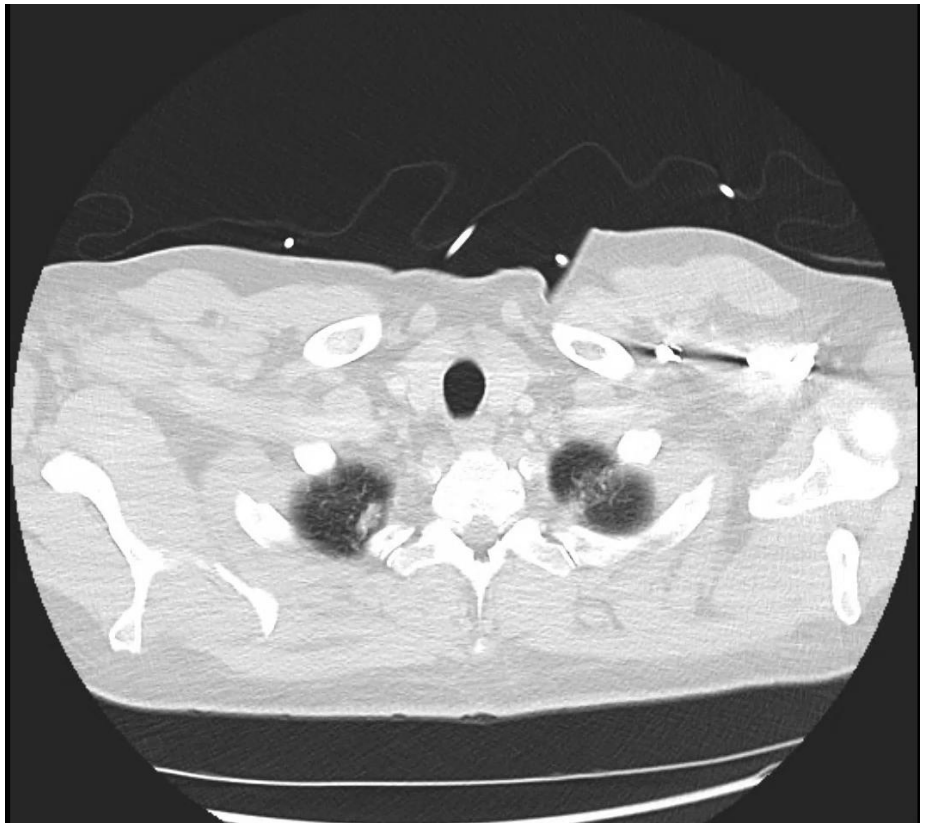
| Lab View | 2025-Oct-05 10:53 EDT |
|---|---|
| **CHEMISTRY** | |
| Glucose Random | 8.9 H |
| Urea (BUN) | 5.3 |
| Creatinine | 58 (f) |
| Sodium | 138 |
| Potassium | 3.9 |
| Chloride | 104 |
| CO2 | 24 |
| Anion Gap | 13.9 |
| Bilirubin, Total | 6 |
| Bilirubin, Conjugated | 0 |
| Bilirubin, Unconjugated | 6 |
| Calcium | 2.14 |
| Corrected Calcium | 2.26 (f) |
| Phosphorus | 1.12 |
| Albumin | 34 L |
| Alkaline Phosphatase | 74 (f) |
| ALT (SGPT) | 79 H |
| Troponin I (mcg/L) | <0.02 (f) |
| NT-proBNP | 270 (f) H |
| Magnesium | 0.92 |
| Lactate | 2.2 |

| | |
|---|---|
| **HEMATOLOGY** | |
| WBC | 18.2 H |
| RBC | 5.24 |
| HGB | 132 L |
| HCT | 0.409 L |
| MCV | 78 L |
| MCH | 25.3 L |
| MCHC | 324 |
| RDW | 14.7 |
| Platelet Count | 552 H |
| MPV | 6.9 L |
| Auto Neutrophils Abs | 15.9 H |
| Auto Lymphocytes Abs | 0.6 L |
| Auto Monocytes Abs | 1.3 H |
| Auto Eosinophils Abs | 0.2 |
| Auto Basophils Abs | 0.1 |
| Auto Nucleated RBC | 0 |
| **COAGULATION** | |
| D Dimer Quantitative | 7,914 (f) C |
| **BLOOD GASES** | |
| Blood Gas Source | Venous |
| PH Venous | 7.42 |
| PCO2 Venous | 40 |
| PO2 Venous | 37 (f) |
| HCO3 | 26 |
| O2 Saturation Venous | 71.9 |
| Base Excess | 1.3 |
| **MICROBIOLOGY** | |
| Culture-Blood | Auth (Verified) REVIEW |

# SMMH Emergency department: CXR




Small bilateral pleural effusions with bibasal atelectasis/consolidation. There is also superimposed moderate pulmonary edema.  Dictated By:  Chingkoe, Dr. Christina M



CT pulmonary angiogram

History: Hospitalized with pneumonia. History of cardiomyopathy. Rule out PE

Comparison: CTPA September 27, 2025

Technique: CT images of the thorax pulmonary arterial phase contrast

Findings:

Satisfactory opacification of the pulmonary arterial tree to the segmental level. Main pulmonary artery measures 3 cm in diameter, at the upper limits of normal. No main, lobar or segmental pulmonary embolus identified. Few opacified subsegmental branches appear patent. No features of right heart dysfunction.

Normal cardiac size. No pericardial effusion. Normal caliber thoracic aorta. No enlarged mediastinal or axillary lymph nodes. Bulky bilateral perihilar lymph nodes measure up to 1.0 cm bilaterally.

The central tracheobronchial tree is patent. Peripheral consolidative opacities at the bilateral upper lobes with subsegmental consolidation at the bilateral lower lobes in keeping with a multifocal infectious/inflammatory process. Groundglass changes seen surrounding the regions of consolidation at the upper and lower lobes. Overall burden appears mildly progressed from prior study. Small bilateral pleural effusions.

The thyroid and esophagus are grossly unremarkable in appearance. The visualized upper abdominal structures demonstrate no acute abnormality. No aggressive osseous lesions.

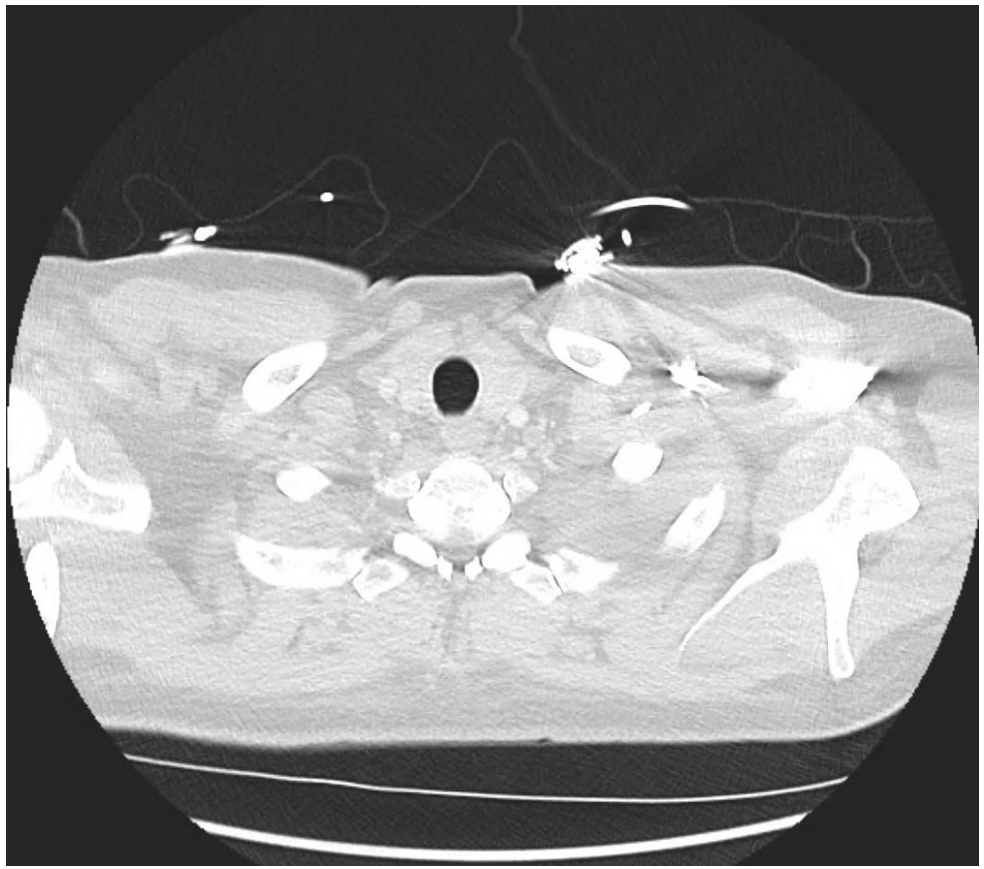
Impression:
1. No evidence of an acute pulmonary embolus.
2. Scattered bilateral pulmonary consolidative opacities with surrounding groundglass changes, greater at the lower lobes in keeping with a multifocal infectious/inflammatory process, appears mildly progressed from recent prior study.  Dictated By:  Maraj, Dr Tishan (Hamilto
Signed Date:  10/05/25 11:57:38

# SMMH Emergency department:
# CT CHEST

| Oxygen Therapy & Oxygenation Information | Oxygen Therapy | Oxygen Saturation | Oxygen Flow Rate | ED FiO2 | RT FiO2 |
|---|---|---|---|---|---|
| 2025-Oct-13 20:03 EDT | High-Flow nasal cannula | 96 | 50 | | 0.65 |
| 2025-Oct-13 20:00 EDT | High-Flow nasal cannula, High flow heated h | 98 | 50 | | |
| 2025-Oct-13 17:15 EDT | High-Flow nasal cannula, Humidification | 96 | 50 | | 0.65 |
| 2025-Oct-13 16:00 EDT | High-Flow nasal cannula | 97 | 50 | 66 | |
| 2025-Oct-13 12:35 EDT | High-Flow nasal cannula, Humidification | 96 | 50 | | 0.75 |
| 2025-Oct-13 12:30 EDT | High-Flow nasal cannula | 95 | 50 | | 0.75 |
| 2025-Oct-13 12:00 EDT | High-Flow nasal cannula | 97 | 60 | 72 | |
| 2025-Oct-13 09:10 EDT | High-Flow nasal cannula, Humidification | 92 L | 50 | | 0.65 |
| 2025-Oct-13 08:00 EDT | High-Flow nasal cannula | 65 C | 45 | | |
| 2025-Oct-13 05:34 EDT | High-Flow nasal cannula, High flow heated h | 92 L | 56 | 51 | |
| 2025-Oct-13 04:10 EDT | High-Flow nasal cannula, High flow heated h | 95 | 50 | | 0.50 |
| 2025-Oct-13 00:00 EDT | High-Flow nasal cannula | 97 | 50 | 50 | |
| 2025-Oct-12 23:55 EDT | High-Flow nasal cannula, High flow heated h | 97 | 50 | | 0.50 |
| 2025-Oct-12 23:14 EDT | High-Flow nasal cannula | 96 | 50 | | |
| 2025-Oct-12 21:15 EDT | High-Flow nasal cannula, High flow heated h | 96 | 50 | | 0.50 |
| 2025-Oct-12 20:00 EDT | High-Flow nasal cannula | 96 | 50 | | |
| 2025-Oct-12 16:13 EDT | High-Flow nasal cannula | 92 L | 50 | | 0.50 |
| 2025-Oct-12 16:00 EDT | Not Done: Not Appropriate at this Time | Not Done: Not Appropriate at this Time | Not Done: Not Appropriate at this Time | Not Done: Not Appropriate at this Time | |
| 2025-Oct-12 12:33 EDT | High-Flow nasal cannula | 96 | 50 | | 0.45 |
| 2025-Oct-12 12:00 EDT | | 95 (c) | 50 (c) | 45 (c) | |
| 2025-Oct-12 10:14 EDT | High-Flow nasal cannula | 97 | 50 | | 0.55 |
| 2025-Oct-12 09:17 EDT | High-Flow nasal cannula | 95 | 55 | | 0.65 |
| 2025-Oct-12 08:05 EDT | Oxymask | 95 | 8 | | |
| 2025-Oct-12 08:00 EDT | High-Flow nasal cannula | 95 | 50 | 50 | |
| 2025-Oct-12 06:00 EDT | High-Flow nasal cannula | 97 | 50 | 50 | |
| 2025-Oct-12 00:00 EDT | Oxymask, Nasal Prongs | 93 L, 85 L | 12, 4.5 | | |
| 2025-Oct-11 20:00 EDT | Nasal Prongs | 94 L | 4.5 | | |
| 2025-Oct-11 16:00 EDT | Not Done: Patient Sleeping | Not Done: Patient Sleeping | Not Done: Patient Sleeping | Not Done: Patient Sleeping | |
| 2025-Oct-11 12:00 EDT | Nasal Prongs | 94 L | 4.5 | | |
| 2025-Oct-11 08:00 EDT | Nasal Prongs | 93 L | 4.5 | | |
| 2025-Oct-11 04:00 EDT | Nasal Prongs | 3 C | 94 | | |
| 2025-Oct-11 00:00 EDT | Not Done: Patient Sleeping | Not Done: Patient Sleeping | Not Done: Patient Sleeping | Not Done: Patient Sleeping | |
| 2025-Oct-10 20:00 EDT | Nasal Prongs (c) | 95 | 3 | | |
| 2025-Oct-10 16:00 EDT | Nasal Prongs | 91 L | 4.5 | | |
| 2025-Oct-10 12:00 EDT | Not Done: Patient Sleeping | Not Done: Patient Sleeping | Not Done: Patient Sleeping | Not Done: Patient Sleeping | |
| 2025-Oct-10 08:00 EDT | Nasal Prongs | 92 L | 4.5 | | |
| 2025-Oct-10 05:30 EDT | Nasal Prongs | 92 L | 4.5 | | |
| 2025-Oct-10 00:00 EDT | Nasal Prongs | 95 | 4.5 | | |
| 2025-Oct-09 20:00 EDT | Nasal Prongs (c) | 92 L | 4.5 | | |
| 2025-Oct-09 16:00 EDT | Nasal Prongs | 91 L | 5 | | |
| 2025-Oct-09 12:00 EDT | Oxymask | 93 L | 5 | | |
| 2025-Oct-09 09:58 EDT | Oxymask | 90 L | 5 | | |
| 2025-Oct-09 08:00 EDT | Oxymask | 88 L | 4 | | |
| 2025-Oct-09 04:00 EDT | Nasal Prongs | 93 L | 4 | | |
| 2025-Oct-09 00:00 EDT | Nasal Prongs | 97 | 5 (f) | | |
| 2025-Oct-08 20:00 EDT | Nasal Prongs | 84 (f) C | 3 | | |
| 2025-Oct-08 16:00 EDT | Nasal Prongs | 90 L | 3 | | |
| 2025-Oct-08 12:30 EDT | Nasal Prongs | 93 L | 3 | | |
| 2025-Oct-08 08:00 EDT | Nasal Prongs | 95 | 2.5 | | |
| 2025-Oct-08 06:20 EDT | Nasal Prongs | 94 L | 2.5 | | |
| 2025-Oct-08 04:00 EDT | Nasal Prongs (c) | 94 L | 2.5 | | |
| 2025-Oct-08 00:00 EDT | Nasal Prongs, Room air | 96, 96 | 2.5 | | |
| 2025-Oct-07 22:00 EDT | Nasal Prongs | 92 L | 2.5 | | |

- 10/05/2025:
  - Right axillary/subclavian DVT diagnosed.
  - CT PE negative for PE but showed bilateral consolidative opacities, progressed since 09/27/2025.
  - Started on Rivaroxaban for DVT and piperacillin-tazobactam 4.5g IV q6h for CAP. Admitted for DVT and CAP.
- 10/08/2025: Started on vancomycin given ongoing hypoxia with no improvement.
- 10/12/2025:
  - Worsening hypoxia.
  - Repeat CT PE showed new right upper lobe pulmonary emboli.
  - Switched from rivaroxaban to enoxaparin.
  - Started on hydrocortisone 50 mg IV Q6H for suspected severe community-acquired pneumonia. Respiratory panel negative.

# CTPE 10/12/2025



PREVIOUS: Ninth of October

FINDINGS:

CHEST WALL,LOWER NECK and AXILLA: Thyroid and lower neck are normal. No axillary adenopathy. Soft tissues of the chest are normal.

MEDIASTINUM and HILUM: Within normal limits.No enlarged hilar or mediastinal lymph nodes..

LUNGS:Trachea and main bronchi are normal. There is consolidation in the lower lobes bilaterally with air bronchograms. Patchy infiltrate seen both upper lobes..

VASCULATURE: There is pulmonary embolus seen right upper lobe pulmonary artery. Aorta and coronary arteries appear normal.

HEART: normal size. No pericardial effusion.

PLEURA: Bilateral pleural effusion

OSSEOUS STRUCTURES: Unremarkable.

LIMITED ABDOMINAL IMAGES: no obvious abnormality.

IMPRESSION:

1. Minimal change in appearance of lungs.
2. Consolidation lower lobes.
3. Bilateral pleural effusion.
4. Pulmonary embolus right upper lobe.  Dictated By:  Chait, Dr. Peter G (Picke
   Signed Date:  10/12/25 11:15:15

Disclaimer

# SMMH HOSPITAL COURSE (10/15/2025)

Ongoing Hypoxia, but intermittent improvements, mainly when pt remaining supine.

Switched from hydrocortisone to methylprednisolone 125 mg IV Q12H.

Empirically started on itraconazole for possible fungal pneumonia.

Infectious w/u – Negative respiratory gram stain + cx, respiratory viral panel (including COVID,influenza,RSV), legionella urine antigen, 1,3 B D-Glucan, AFB gram stain (cx pending), blood cultures, HIV test negative. IGRA indeterminate.

CTD w/u – ANA, ENA, RF, Anti-SCL 70, Anti-SSA/RO, Anti-GBM, MPO, PR3

Repeat CT PE showed mild decrease in right upper lobe PE with no new emboli; lung opacities stable from three days prior.

# SMMH HOSPITAL COURSE – POSITIONAL HYPOXIA

| ALL RESULT SECTIONS | | | | | | |
|---|---|---|---|---|---|---|
| Oxygen Therapy & Oxygenation Information | Oxygen Therapy | Oxygen Saturation | SpO2 | Oxygen Flow Rate | ED FiO2 | RT FiO2 |
| 2025-Oct-17 18:00 EDT | Endotracheal Tube, Ventilator | 94 L | Not Done: Task Duplication (f) | Not Done: Task Duplication (f) | | Not Done: Task Duplication (f) |
| 2025-Oct-17 17:45 EDT | Endotracheal Tube, Ventilator | 94 L | 93 L | | | 0.6, 0.60 |
| 2025-Oct-17 14:30 EDT | High-Flow nasal cannula, High flow heated h | 97 | | 60 | 90 | |
| 2025-Oct-17 11:15 EDT | High flow heated humidity | 94 L | | 40 | | 0.85 |
| 2025-Oct-17 10:00 EDT | High-Flow nasal cannula, High flow heated h | 92 L | | 40 | 85 | |
| 2025-Oct-17 08:46 EDT | High-Flow nasal cannula, High flow heated h | 94 L | | 40 | 70 | |
| 2025-Oct-17 06:15 EDT | | 90 L | | 40 | 70 | |
| 2025-Oct-17 06:00 EDT | High flow heated humidity | 90 L | | 40 | 50 | |
| 2025-Oct-17 04:25 EDT | High-Flow nasal cannula, Humidification | 95 | | 40 | | 0.50 |
| 2025-Oct-17 02:00 EDT | High-Flow nasal cannula, High flow heated h | 95 | | 40 | 50 | |
| 2025-Oct-17 00:05 EDT | High-Flow nasal cannula, Humidification | 95 | | 40 | | 0.50 |
| 2025-Oct-16 23:46 EDT | High flow heated humidity | 95 | | 40 | 65 | |
| 2025-Oct-16 20:35 EDT | High-Flow nasal cannula, Humidification | 95 | | 40 | | 0.70 |
| 2025-Oct-16 20:00 EDT | | 96 | | 40 | 70 | |
| 2025-Oct-16 18:30 EDT | High flow heated humidity | 93 L | | 40 | | 0.80 |
| 2025-Oct-16 15:30 EDT | High flow heated humidity | 98 | | 40 | | 0.80 |
| 2025-Oct-16 14:58 EDT | High-Flow nasal cannula | 100 | | 50 | 90 | |
| 2025-Oct-16 11:05 EDT | High flow heated humidity | 92 L | | 50 | | 0.90 |
| 2025-Oct-16 11:00 EDT | High-Flow nasal cannula | 93 L | | 50 | 90 | |
| 2025-Oct-16 09:00 EDT | High flow heated humidity | 85 L | | 40 | | 0.45 |
| 2025-Oct-16 08:00 EDT | High-Flow nasal cannula | 94 L | | 40 | 50 | |
| 2025-Oct-16 07:07 EDT | High-Flow nasal cannula | 94 L | | 40 | 50 | |
| 2025-Oct-16 06:20 EDT | High-Flow nasal cannula, High flow heated h | 95 | | 40 | | 0.45 |
| 2025-Oct-16 03:33 EDT | High-Flow nasal cannula | 91 L | | 40 | 50 | |
| 2025-Oct-16 02:00 EDT | High-Flow nasal cannula, High flow heated h | 94 L | | 40 | | 0.45 |
| 2025-Oct-16 00:00 EDT | High-Flow nasal cannula | 97 | | 40 | 50 | |
| 2025-Oct-15 23:53 EDT | High-Flow nasal cannula, High flow heated h | 92 L | | 40 | | 0.45 |
| 2025-Oct-15 22:33 EDT | High flow heated humidity | 95 | | 40 | 50 | |
| 2025-Oct-15 20:50 EDT | High-Flow nasal cannula, High flow heated h | 97 | | 40 | | 0.45 |
| 2025-Oct-15 20:00 EDT | High flow heated humidity | 95 | | 40 | 50 | |
| 2025-Oct-15 16:00 EDT | High-Flow nasal cannula | 95 | | 40 | 50 | |
| 2025-Oct-15 15:25 EDT | High-Flow nasal cannula | 99 | | 40 | | 0.50 |
| 2025-Oct-15 14:10 EDT | High-Flow nasal cannula | 99 | | 40 | | 0.60 |
| 2025-Oct-15 12:00 EDT | High-Flow nasal cannula | 94 L | | 50 | 100 | |
| 2025-Oct-15 11:45 EDT | High-Flow nasal cannula | 94 L | | 40 | | 0.50 |
| 2025-Oct-15 11:21 EDT | | 94 L | | | | |
| 2025-Oct-15 09:15 EDT | High-Flow nasal cannula | 93 L | | 40 | | 0.60 |
| 2025-Oct-15 08:40 EDT | High-Flow nasal cannula | 95 | | 40 | | 0.40 |
| 2025-Oct-15 08:00 EDT | High-Flow nasal cannula | 94 L | | 40 | 40 | |
| 2025-Oct-15 05:46 EDT | High flow heated humidity | 94 L | | 40 | | 0.50 |
| 2025-Oct-15 05:21 EDT | High flow heated humidity | 94 L | | 40 | | 0.40 |
| 2025-Oct-15 04:00 EDT | High flow heated humidity | 92 L | | 40 | 0.4 | |
| 2025-Oct-15 00:59 EDT | High flow heated humidity | 95 | | 40 | | 0.40 |
| 2025-Oct-15 00:00 EDT | High flow heated humidity | 94 L | | 40 | 0.4 | |
| 2025-Oct-14 21:09 EDT | High flow heated humidity | 94 L | | 40 | | 0.40 |
| 2025-Oct-14 20:00 EDT | High flow heated humidity | 94 L | | 40 | 0.4 | |
| 2025-Oct-14 16:30 EDT | High-Flow nasal cannula, Humidification | 97 | | 40 | | 0.40 |
| 2025-Oct-14 16:00 EDT | High-Flow nasal cannula | 96 | | 40 | 40 | |
| 2025-Oct-14 12:15 EDT | High-Flow nasal cannula, Humidification | 96 | | 50 | | 0.65 |
| 2025-Oct-14 12:00 EDT | High-Flow nasal cannula | 97 (c) | | 65 | 50 (c) | |
| 2025-Oct-14 08:40 EDT | High-Flow nasal cannula, Humidification | 94 L | | 50 | | 0.90 |
| 2025-Oct-14 08:00 EDT | High-Flow nasal cannula | 97 | | 50 | 93 | |
| 2025-Oct-14 06:23 EDT | High-Flow nasal cannula | 94 L | | 50 | | 0.60 |

| | | | |
|---|---|---|---|
| Order: | Culture-Respiratory | Collect Date/Time: | 2025-Oct-09 18:15:00 E |
| Growth Ind: | | Last Update Date/Time: | 2025-Oct-09 18:15:00 E |
| Status: | Completed | Testing Site: | |
| Source: | Sputum | Freetext Source: | Sputum |
| Body Site: | | Accession #: | 000002025282000864 |

Hide All

Final by Shared Hospital, Lab on 2025-Oct-12 07:36:09 EDTand Shared Hospital, Lab or

SCANT GROWTH RESPIRATORY FLORA

Testing Site: Shared Hospital Laboratory Inc., Sunnybrook Hospi
Toronto, ON, M4N3M5

Preliminary by Shared Hospital, Lab on 2025-Oct-10 17:35:10 EDTand Shared Hospital,

Testing Site: Shared Hospital Laboratory Inc., Sunnybrook Hospi
Toronto, ON, M4N3M5

GS by Shared Hospital, Lab on 2025-Oct-12 07:36:09 EDTand Shared Hospital, Lab on

FEW PUS CELLS SEEN
RARE EPITHELIAL CELLS SEEN
RARE GRAM POSITIVE COCCI SEEN

| TEST | RESULT | FLAG | NORMAL/THERAPEUTIC RANGE | UNITS | TEST SITE |
|---|---|---|---|---|---|
| Fungitell Quantitative Value | <31 | | <60 | pg/mL | ICL1 |
| Fungitell Qualitative Result | Negative | | Negative | | ICL1 |

No (1,3)-Beta-D-glucan detected.

This assay does not detect certain fungi, including Cryptococcus species, which produce very low levels of (1,3)-Beta-D-Glucan (BDG) and the Mucorales (eg, Lichthemia, Mucor, and Rhizopus), which are not known to produce BDG. Additionally, the yeast phase of Blastomyces dermatitidis produces little BDG and may not be detected by this assay.

| | | |
|---|---|---|
| BINAX NOW Legionella Urinary Antigen Test | Presumptive NEGATIVE for L. pneumophila serogroup 1 | 2025-10-07 *C |

| | |
|---|---|
| Coccidioides immitis IgM EIA | Non-Reactive |
| Coccidioides immitis IgG EIA | Non-Reactive |
| Coccidioides immitis Interpretation | No detectable level of antibody against Coccidioides immitis |

Note: A Non-Reactive serologic test result does not rule out the possibility of current infection. If coccidiomycosis suspected submit a new specimen for repeat serology, or submit appropriate specimens for culture.

| | |
|---|---|
| Histoplasma capsulatum (H band) by Immunodiffusion | Non-Reactive |
| Histoplasma capsulatum (M band) by Immunodiffusion | Non-Reactive |
| Histoplasmosis - Interpretation | No detectable level of antibody against Histoplasma capsulatum |

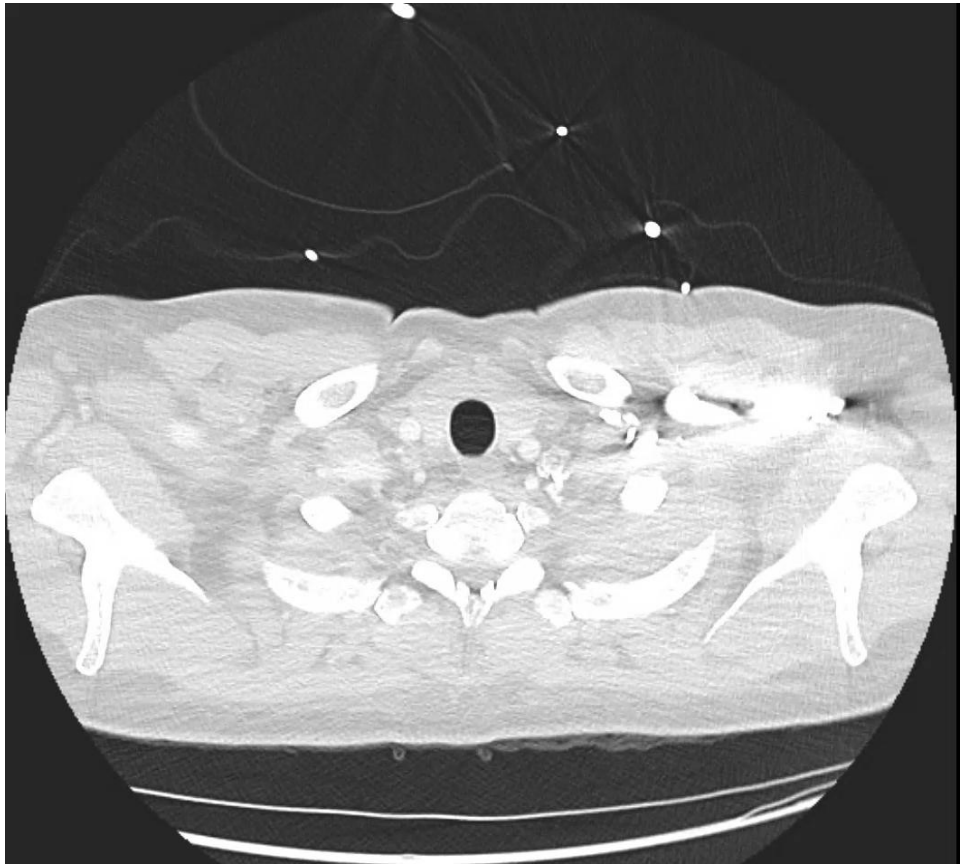
Note: A negative test does not exclude a diagnosis of histoplasmosis. If histoplasmosis is suspected, submit a nev specimen for repeat serology, or submit appropriate specimens for culture.

Not Detected ADENOVIRUS
COVID-19 virus NOT detected by real-time PCR.
Not Detected RHINO/ENTEROVIRUS
Not Detected INFLUENZA A
Not Detected INFLUENZA A SUBTYPE H1
Not Detected INFLUENZA A SUBTYPE H3
Not Detected INFLUENZA B
Not Detected HUMAN CORONAVIRUSES (OC43/229E/NL63/HKU1)
Not Detected HMPV
Not Detected PARAINFLUENZA VIRUS TYPES 1,2,3,4
Not Detected RSV
Note:
This is a validated Laboratory-developed real-time PCR test.
The results should be interpreted based on the clinical context

Testing Site: Shared Hospital Laboratory Inc., Sunnybrook Hospita
Toronto, ON, M4N3M5

# Infectious w/u

# CT CHEST 10/15/2025



No specific findings of right heart strain. No pericardial effusions.

Imaged portions of the thyroid and supraclavicular fossa are unremarkable.

There are no new enlarged mediastinal lymph nodes stable 1.1 cm subaortic lymph node. Stable 1.2 cm subcarinal lymph nodes.

Stable appearance of the hila. No new enlarged lymph nodes.

No enlarged axillary lymph nodes.

The central tracheobronchial tree is patent.

Redemonstration of opacification of both lower lobes with air bronchograms. Redemonstration of near complete opacification of the right middle lobe

Redemonstration of patchy airspace opacities throughout both upper lobes. No significant change compared to most recent scan. Progression compared to earlier scan from September 2025.

Right pleural effusion measuring up to 3.9 cm in depth. Left pleural effusion measuring 3.0 cm in depth. No significant change compared to most recent scan. Pleural effusions are new compared to earlier scan from September 2025.

No concerning findings in the partially imaged upper abdomen.

No aggressive osseous lesions.

IMPRESSION:

Mild decrease in size of filling defect in the right upper lobe apical segmental pulmonary artery bifurcation point. No new pulmonary embolism identified.

Opacified appearance of both lower lobes and most of the right middle lobe as well as patchy opacities in the upper lobes stable compared to CT scan performed 3 days ago but progressed compared to earlier scan from September 2025.

Mild to moderate sized bilateral pleural effusions also stable compared to most recent scan but new compared to earlier scan from September  Dictated By:  Satkunasingham, Dr. Janak

# SMMH HOSPITAL COURSE (10/16/2025)

Oxygen requirements increased to 90% FiO2, transferred to ICU.

Trialed on high-dose steroids with methylprednisolone 500 mg IV for ? fulminant organizing pneumonia.

Trial of Lasix 40 mg IV every 12 hours for?  Pulmonary edema.  Significant diuresis with 5.4 L out and net -3.2 L.

Piperacillin and vancomycin discontinued given no improvement on either x 10 days.

Doxycycline 100 mg p.o. twice daily added for possible zoonotic infectious source of pneumonia.

# SMMH HOSPITAL COURSE (10/17/2025)

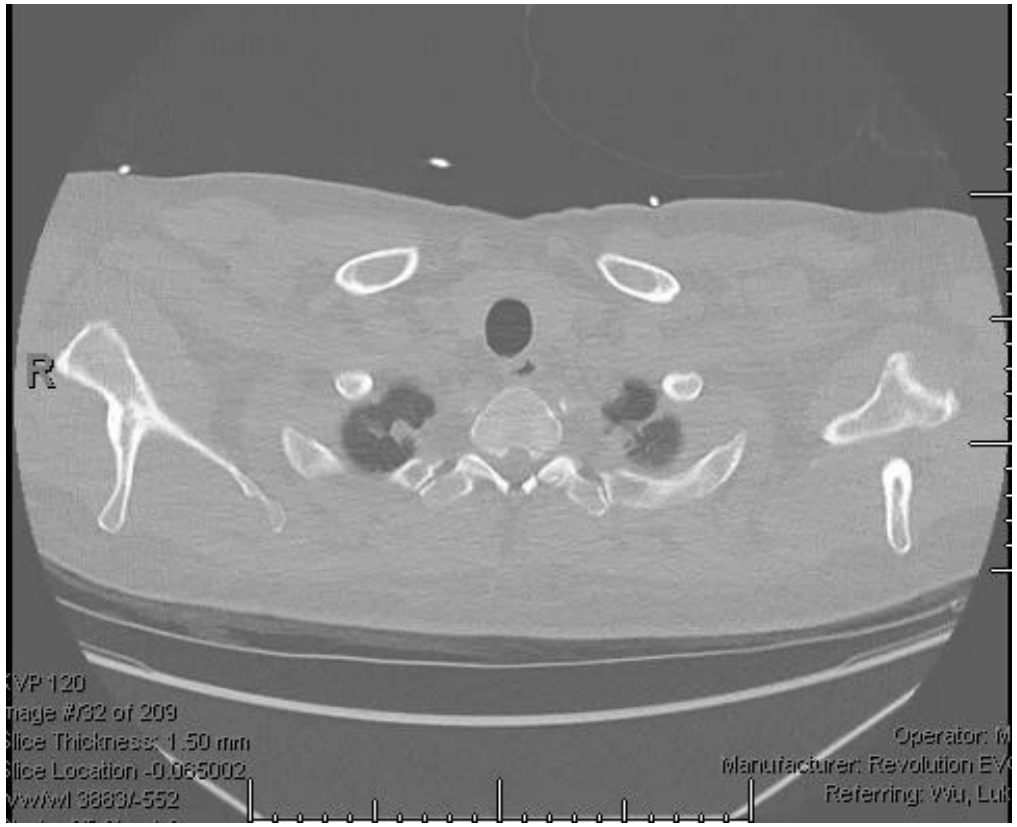
FiO2 down to around 60% while laying flat overnight, but early morning had to get up to have a bowel movement and desaturating down into the 70s with runs of SVT.

Upon returning to bed still hypoxic and so FiO2 increased back up to 90% and desaturating back up to 97%.

Completed high-resolution CT chest for workup of ILD which again showed similar patchy ill-defined prominent subpleural densities and small to moderate bilateral pleural effusions with underlying confluent opacification of air bronchograms in both lower lobes.

Underwent echocardiogram with agitated saline to assess for PFO/ASD, formal report pending but echo tech did not see any obvious shunt.

Completed an abdominal ultrasound with portal vein Doppler which only showed mild hepatic steatosis with no evidence of cirrhosis and no ascites.  Hepatic and portal veins were patent.




There once again confluent regions of atelectasis/consolidation in much of the bilateral lower lobes underlying the bilateral pleural effusions with bronchograms throughout. There are also similar patchy predominantly subpleural ill-defined mixed consolidative and groundglass densities in both lungs with upper lobe predominance. There is once again the occasional small pulmonary nodule measuring up to 0.5 cm the lateral left upper lobe (image 32).

No acute osseous findings.

IMPRESSION:

1. Similar findings to recent CT pulmonary angiogram from October 15, 2025.
2. Similar small to moderate bilateral pleural effusions with underlying confluent opacification air bronchograms in both lower lobes.
3. Similar patchy ill-defined prominent subpleural densities elsewhere remaining aerated lungs.
4. Overall, lung findings are nonspecific, but could fit with organizing pneumonia given the provided clinical history.
5. Clinical and imaging follow-up is advised.

# High resolution CT Chest (10/17/2025)

# SMMH HOSPITAL COURSE: LAB REVIEW

| HEMATOLOGY | WBC | RBC | HGB | HCT | MCV | MCH | MCHC | RDW |
|---|---|---|---|---|---|---|---|---|
| 2025-Oct-17 05:19 EDT | 9.9 | 4.62 | 116 L | 0.352 L | 76 L | 25.0 L | 328 | 14.9 |
| 2025-Oct-15 07:25 EDT | 10.6 | 4.22 L | 105 L | 0.324 L | 77 L | 24.9 L | 325 | 14.9 |
| 2025-Oct-14 08:16 EDT | 15.6 H | 4.51 | 113 L | 0.359 L | 80 | 25.0 L | 314 L | 14.8 |
| 2025-Oct-13 07:17 EDT | 13.7 H | 4.59 | 113 L | 0.352 L | 77 L | 24.7 L | 321 | 15.0 |
| 2025-Oct-12 06:30 EDT | 13.3 H | 4.11 L | 104 L | 0.314 L | 76 L | 25.3 L | 331 | 14.5 |
| 2025-Oct-10 18:03 EDT | 13.3 H | 4.55 | 112 L | 0.354 L | 78 L | 24.7 L | 318 L | 14.6 |
| 2025-Oct-10 06:02 EDT | 11.7 H | 4.27 L | 106 L | 0.331 L | 77 L | 24.8 L | 321 | 14.5 |
| 2025-Oct-09 06:07 EDT | 12.3 H | 4.27 L | 107 L | 0.331 L | 78 L | 25.1 L | 324 | 14.6 |
| 2025-Oct-08 06:25 EDT | 13.5 H | 4.38 L | 109 L | 0.338 L | 77 L | 24.9 L | 322 | 14.5 |
| 2025-Oct-07 08:38 EDT | 13.6 H | 4.48 L | 112 L | 0.347 L | 78 L | 24.9 L | 321 | 14.6 |
| 2025-Oct-06 06:39 EDT | 16.9 H | 4.57 | 115 L | 0.352 L | 77 L | 25.1 L | 327 | 14.7 |
| 2025-Oct-05 10:53 EDT | 18.2 H | 5.24 | 132 L | 0.409 L | 78 L | 25.3 L | 324 | 14.7 |

| HEMATOLOGY | Platelet Count | MPV | Auto Neutrophils Abs | Auto Lymphocytes Abs | Auto Monocytes Abs | Auto Eosinophils Abs | Auto Basophils Abs | Auto Nucleated RBC |
|---|---|---|---|---|---|---|---|---|
| 2025-Oct-17 05:19 EDT | 449 | 7.2 L | 8.7 H | 1.0 | 0.3 | 0.0 | 0.0 | 0 |
| 2025-Oct-15 07:25 EDT | 457 H | 6.8 L | 8.6 H | 0.8 L | 1.1 H | 0.0 | 0.0 | 0 |
| 2025-Oct-14 08:16 EDT | 524 H | 6.9 L | 13.4 H | 1.2 | 0.8 | 0.1 | 0.0 | |
| 2025-Oct-13 07:17 EDT | 471 H | 7.0 L | 12.2 H | 0.8 L | 0.6 | 0.0 | 0.1 | 0 |
| 2025-Oct-12 06:30 EDT | 428 | 6.8 L | 10.4 H | 1.0 | 1.4 H | 0.5 | 0.1 | 0 |
| 2025-Oct-10 18:03 EDT | 440 | 6.7 L | 10.7 H | 0.9 L | 1.1 H | 0.5 | 0.1 | 0 |
| 2025-Oct-10 06:02 EDT | 443 | 7.1 L | 8.7 H | 1.1 | 1.1 H | 0.6 H | 0.1 | 0 |
| 2025-Oct-09 06:07 EDT | 455 H | 7.0 L | 9.5 H | 1.0 | 1.1 H | 0.7 H | 0.1 | 0 |
| 2025-Oct-08 06:25 EDT | 446 | 6.9 L | 10.0 H | 1.3 | 1.3 H | 0.8 H | 0.1 | 0 |
| 2025-Oct-07 08:38 EDT | 455 H | 7.0 L | 10.3 H | 1.3 | 1.3 H | 0.6 H | 0.1 | 0 |
| 2025-Oct-06 06:39 EDT | 459 H | 6.9 L | 13.9 H | 1.1 | 1.4 H | 0.5 | 0.0 | 0 |
| 2025-Oct-05 10:53 EDT | 552 H | 6.9 L | 15.9 H | 0.6 L | 1.3 H | 0.2 | 0.1 | 0 |

| HEMATOLOGY | Normal erythrocytes | Platelet aggregates | Platelet Estimation | Smear | ESR (Sed Rate) | | | |
|---|---|---|---|---|---|---|---|---|
| 2025-Oct-17 05:19 EDT | | | | | 22 (f) H | | | |
| 2025-Oct-14 08:16 EDT | Present | Present A | Appears Increased A | Reviewed | | | | |
| 2025-Oct-09 12:52 EDT | | | | | 72 (f) H | | | |

| COAGULATION | D Dimer Quantitative |
|---|---|
| 2025-Oct-05 10:53 EDT | 7,914 (f) C |

| SEROLOGY | Anti-SSA/RO | Scl 70 Antibodies | ANA Screen | Anti-ENA | Anti-Glomerular Basement Membrane | C-Reactive Protein | Galactomannan Asperg. Ag | Specimen Description |
|---|---|---|---|---|---|---|---|---|
| 2025-Oct-17 05:19 EDT | | | | | <0 (f) | 9.6 (f) H | | |
| 2025-Oct-09 12:52 EDT | <0.2 (f) | <0.2 (f) | ANA - Press Enter or Double Click to View Deta | Anti-ENA - Press Enter or Double Click to View | | 84.0 (f) H | | |
| 2025-Oct-08 09:25 EDT | | | | | | | Galactomannan Asperg. Ag - Press Enter or Do | Specimen Description - Press Enter or Double C |

| SEROLOGY | Galactomannan Index | Galactomannan Comment | Rheumatoid Factor |
|---|---|---|---|
| 2025-Oct-09 12:52 EDT | | | 10 (f) |
| 2025-Oct-08 09:25 EDT | 0.0700 (f) | Galactomannan Comment - Press Enter or Dou | |

| REFERRALS | c-ANCA (anti-PR3) | p-ANCA (anti-MPO) | Anti-CCP | Flow Cytometry | TProtein (Ref) | Albumin (Ref) | Alpha 1 Globulin (Ref) | Alpha 2 Globulin (Ref) |
|---|---|---|---|---|---|---|---|---|
| 2025-Oct-17 05:19 EDT | <0 (f) | <0.2 (f) | | | | | | |
| 2025-Oct-09 12:52 EDT | <0 (f) | <0.2 (f) | <8.0 (f) | | | | | |

# Community Acquired Pneumonia

Review on diagnosis and management of CAP

(based on IDSA 2019 CAP Guidelines)

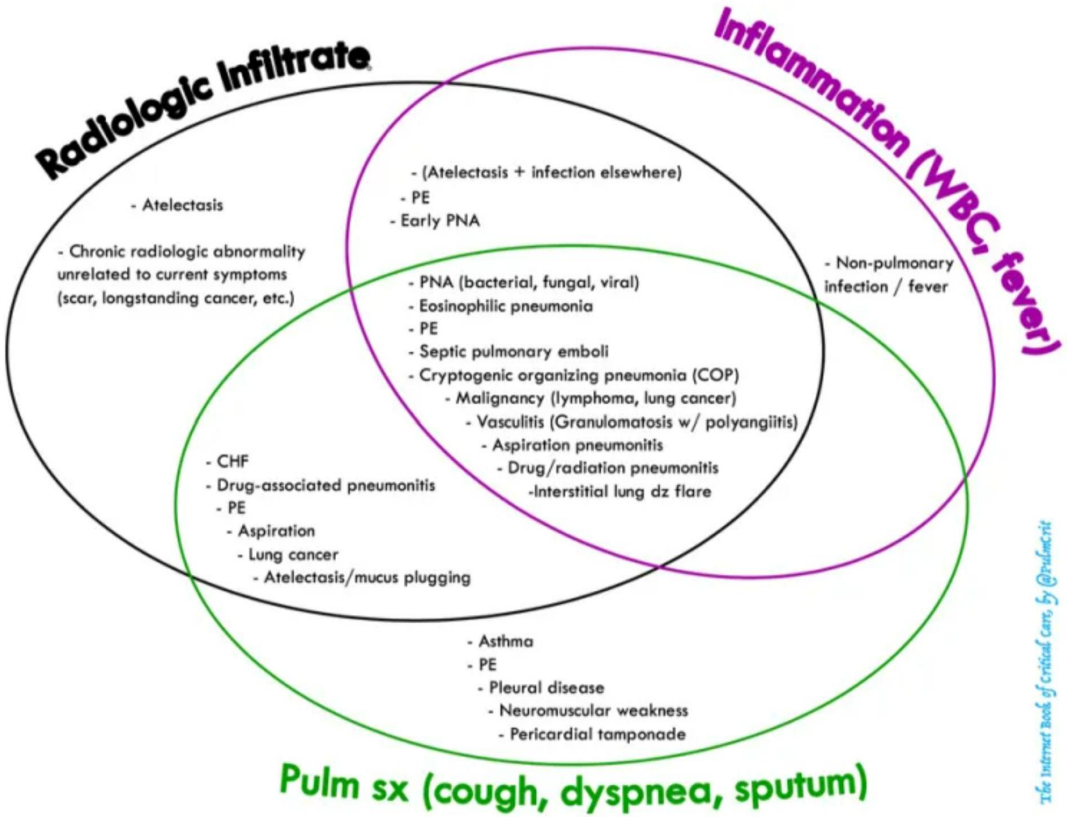
# CAP - DDx

**TABLE 1: Diagnosis of Community-acquired Pneumonia in Adults (≥ 18 years) Without Immunocompromising Conditions**[1*]

| |
|---|
| Newly recognized pulmonary infiltrate(s) on chest imaging[†] |
| **AND** at least one respiratory symptom |
| **AND** at least one other symptom/sign or finding (see below) |
| **Respiratory Symptoms (at least one)** |
| New or increased cough |
| New or increased sputum production |
| Dyspnea |
| Pleuritic chest pain |
| **Other Signs or Findings (at least one)** |
| Abnormal lung sounds (rhonchi or rales) |
| Fever (≥100.4 °F) |
| Leukocytosis or unexplained bandemia (above normal limits for laboratory) |
| Hypoxia (< 90%) |

*Immunocompromising conditions include inherited or acquired immune deficiency or drug-induced neutropenia, including patients actively receiving cancer chemotherapy, patients infected with HIV with suppressed CD4 counts, and solid organ or bone marrow transplant recipients.

†If clinical suspicion for community-acquired pneumonia is high despite negative chest radiograph, consider a CT scan of the chest.[2]



# CAP: Severity Scoring

**TABLE 2: Criteria for Defining Severe Community-acquired Pneumonia**[1]

| One major criterion **OR** three or more minor criteria | |
|---|---|
| **Major Criteria** | Septic shock with need for vasopressors |
| | Respiratory failure requiring mechanical ventilation |
| **Minor Criteria** | Respiratory rate ≥ 30 breaths/min |
| | $PaO_2/FIO_2$ ratio ≤ 250* |
| | Multilobar (i.e., ≥ 2) infiltrates |
| | Confusion/disorientation |
| | Uremia (blood urea nitrogen level ≥ 20 mg/dl) |
| | Leukopenia (white blood cell count < 4,000 cells/μl)† |
| | Thrombocytopenia (platelet count < 100,000/μl) |
| | Hypothermia (core temperature < 36°C) |
| | Hypotension requiring aggressive fluid resuscitation |

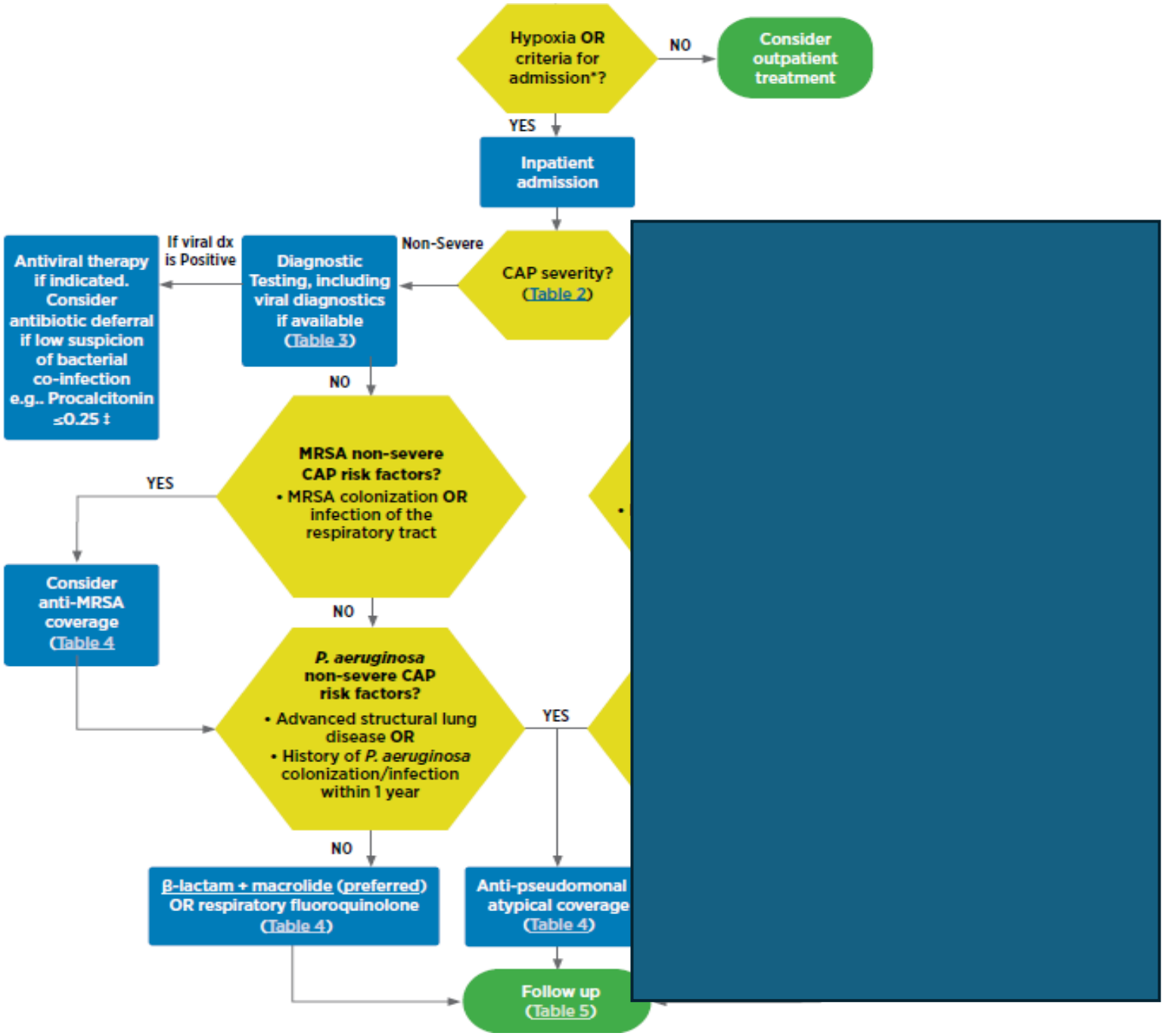
* $PaO_2/FIO_2$ ratio is the ratio of patient's oxygen in arterial blood ($PaO_2$) to the fraction of the oxygen in the inspired air ($FIO_2$).[3]

† Due to infection alone (i.e., not chemotherapy)

# CAP: Work up

| | Non-severe CAP* | Severe CAP* |
|---|---|---|
| **Blood** | | |
| Blood culture | Not routinely recommended† | Yes |
| Procalcitonin‡ | Consider if available and recommended by hospital guidelines | Yes, if available and recommended by hospital guidelines |
| **Respiratory** | | |
| Respiratory culture | Not routinely recommended unless:<br>• hospitalization and parenteral antibiotics in the last 90 days<br>OR<br>• anti-MRSA or anti – *P. aeruginosa* coverage is intiated<br>OR<br>• advanced structural lung disease§ | Yes |
| Molecular testing for bacterial pathogens‡ | Not routinely recommended† | Yes, if available and recommended by hospital guidelines |
| MRSA nasal swab (marker of MRSA colonization)* | Yes, if:<br>• hospitalization and parenteral antibiotics in the last 90 days<br>OR<br>• anti-MRSA coverage is intiated | Yes, if<br>• hospitalization and parenteral antibiotics in the last 90 days<br>OR<br>• history of MRSA colonization or infection at any site within 1 year<br>OR<br>• anti-MRSA coverage is intiated |
| **Viruses** | | |
| Influenza testing | Yes, if presence of virus in community, travel risk or potential exposure | Yes, if presence of virus in community, travel risk or potential exposure |
| COVID-19 testing‡ | Yes, if presence of virus in community, travel risk or potential exposure | Yes, if presence of virus in community, travel risk or potential exposure |
| Expanded viral molecular panel (e.g., rhinovirus, enterovirus, RSV)‡ | Consider if available† | Yes, if available† |
| **Urine** | | |
| Legionella urine antigen test | Yes, if recent outbreak, travel or other epidemiological factors | Yes |

# CAP: Treatment



# CAP: Treatment

**TABLE 4: Initial Treatment for Hospitalized Patients with Community-Acquired Pneumonia (CAP) Stratified by Disease Severity and Risk for Antibiotic Resistant Pathogens[1]**

**(Note: Modify per hospital formulary and/or preferred antibiotics)**

**Allergy Alert‡:** Use evidence-based validated risk strategies for evaluating β-lactam allergy and cross-reactivity to other β-lactams (add references). Patients with mild to moderate penicillin reactions[5] can typically tolerate non-pencillin β-lactams. Obtain a detailed history as these patients may be de-labled based on tolerated penicillin-class agents since the initial reaction[6]. Patients with immediate penicillin reactions (e.g., urticaria, angioedema, anaphylaxis) within 1 hour of β-lactam penicillin exposure may tolerate 3rd/4th generation cephalosporins or carbapenems[7]. Avoid β-lactams in patients with severe delayed cutaneous reactions (e.g., Stevens-Johnson syndrome, toxic epidermal necrolysis)[8].

| | Standard Regimen | | Recent hospitalization and parenteral antibiotics in the last 90 days | | | History of MRSA colonization or infection at any site within 1 year OR MRSA nasal PCR positive | History of P. aeruginosa colonization or infection at any site within 1 year OR Advanced structural lung disease | |
|---|---|---|---|---|---|---|---|---|
| **Non-severe CAP** | **β-lactam PLUS Atypical Coverage (Preferred)** | | **β-lactam PLUS Atypical Coverage (same as standard regimen)** | | | **MRSA Coverage** | **β-lactam PLUS Atypical Coverage** | |
| | *Choose One:*<br>Ampicillin/ sulbactam *1.5-3g IV q6h*<br>Ceftriaxone *1-2g IV q24h (2g if >80kg)*[9,10]<br>Cefotaxime *1-2g IV q8h* | *Choose One:*<br>Azithromycin *500mg IV/PO q24h**<br>Clarithromycin *500mg IV/PO q12h*<br>Doxycycline *100mg IV/PO q12h***<br>**Monotherapy (alternative if above regimen is not tolerated)**<br>*Choose One:*<br>Levofloxacin *750mg IV/PO q24h*<br>Moxifloxacin *400mg IV/PO q24h* | | | | *Choose One:*<br>Vancomycin *per hospital guidelines*<br>Linezolid *600 mg IV/PO* | *Choose One:*<br>Piperacillin/ tazobactam *4.5g IV q6h*<br>Cefepime *2g IV q8h*<br>Ceftazidime 2g IV q8h<br>Imipenem *500mg IV q6h*<br>Meropenem *1000mg IV q8h* | *Choose One:*<br>Azithromycin *500mg IV/PO q24h**<br>Clarithromycin *500mg IV/PO q12h*<br>Doxycycline 100mg IV/PO q12**<br>Levofloxacin *750mg IV/PO q24h*<br>Moxifloxacin *400mg* |
| **Severe CAP** | **β-lactam PLUS Atypical Coverage** | | **MRSA Coverage** | **β-lactam PLUS Atypical Coverage** | | **MRSA Coverage** | **β-lactam PLUS Atypical Coverage** | |
| | *Choose One:*<br>Ampicillin/ sulbactam *1.5-3g IV q6h*<br>Ceftriaxone *2g IV q24h*[11,12]‡<br>Cefotaxime *1-2g IV q8h* | *Choose One:*<br>Azithromycin *500mg IV/PO q24h**<br>Clarithromycin *500mg IV/PO q12h*<br>Doxycycline *100mg IV/PO q12h***<br>Levofloxacin *750mg IV/PO q24h*<br>Moxifloxacin *400mg IV/PO q24h* | *Choose One:*<br>Vancomycin *per hospital guidelines*<br>Linezolid *600 mg IV/PO q12h* | *Choose One:*<br>Piperacillin/ tazobactam *4.5g IV q6h*<br>Cefepime *2g IV q8h*<br>Ceftazidime *2g IV q8h*<br>Imipenem *500mg IV q6h*<br>Meropenem *1000mg IV q8h* | *Choose One:*<br>Azithromycin *500mg IV/PO q24h**<br>Clarithromycin *500mg IV/PO q12h*<br>Doxycycline *100mg IV/PO q12***<br>Levofloxacin *750mg IV/PO q24h*<br>Moxifloxacin *400mg IV/PO q24h* | *Choose One:*<br>Vancomycin *per hospital guidelines*<br>Linezolid *600 mg IV/PO q12h* | *Choose One:*<br>Piperacillin/ tazobactam *4.5g IV q6h*<br>Cefepime *2g IV q8h*<br>Ceftazidime *2g IV q8h*<br>Imipenem *500mg IV q6h*<br>Meropenem *1000mg IV q8h* | *Choose One:*<br>Azithromycin *500mg IV/PO q24h**<br>Clarithromycin *500mg IV/PO q12h*<br>Doxycycline *100mg IV/PO q12***<br>Levofloxacin *750mg IV/PO q24h*<br>Moxifloxacin *400mg IV/PO q24h* |

**Severe CAP with allergy to β-lactams:** Consider levofloxacin 750mg IV/PO q24h ± aztreonam 2g IV q8h +/- MRSA coverage

* Azithromycin 500mg q24 hours x 3 doses for 1500mg total to treat atypical pneumonia[13,14]

** Macrolide intolerance or QTc prolongation

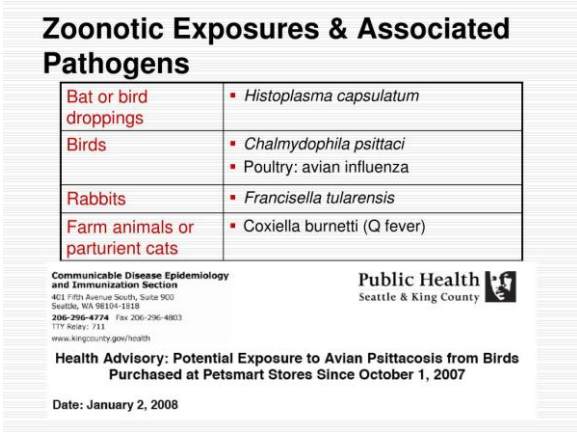
‡ This is a clinical practice enhancement to the ATS/IDSA CAP clinical practice guideline

Notes:

- Antibiotic selections should be driven by local antibiograms
- Patients with septic shock should receive therapy per hospital sepsis guidelines
- Antibiotic dosing should be adjusted according to hospital guidelines and renal/liver insufficiency
- The following FDA-approved agents may be considered in non-severe CAP patients who are not candidates for β-lactams, macrolides or FQs: lefamulin 150 mg IV q 12

# Atypical coverage

- Doxycycline 200 mg PO/IV loading dose followed by 100 PO/IV BID.
  - Specific indications for doxycycline in CAP include:
    - Animal exposure (covers zoonotic pneumonias).
    - Low-key MRSA coverage: Patients are at moderate risk for community-acquired MRSA pneumonia, but not enough risk to justify linezolid/vancomycin. Doxycycline exhibits fair activity against MRSA in vitro; however, there is limited evidence of its efficacy in treating MRSA pneumonia.
- Azithromycin 500 mg IV QD x3 days is an alternative. Azithromycin is preferred for patients with suspected Legionella pneumonia.



**Zoonotic Exposures & Associated Pathogens**

| | |
|---|---|
| Bat or bird droppings | ▪ *Histoplasma capsulatum* |
| Birds | ▪ *Chalmydophila psittaci*<br>▪ Poultry: avian influenza |
| Rabbits | ▪ *Francisella tularensis* |
| Farm animals or parturient cats | ▪ Coxiella burnetti (Q fever) |

Communicable Disease Epidemiology and Immunization Section
401 Fifth Avenue South, Suite 900
Seattle, WA 98104-1818
206-296-4774 Fax 206-296-4803
TTY Relay: 711
www.kingcounty.gov/health

Public Health
Seattle & King County

**Health Advisory: Potential Exposure to Avian Psittacosis from Birds Purchased at Petsmart Stores Since October 1, 2007**

**Date: January 2, 2008**

https://www.slideserve.com/shaina/community-acquired-pneumonia

# CAP Treatment - Anaerobic coverage

## ANAEROBIC COVERAGE

### Indications:

- Parapneumonic effusions
  - At least moderate in size without definitive management with thoracentesis / chest tube.
  - Treatment for 2-6 weeks as per BTS Guideline criteria .
  - Repeat chest imaging q1-2 weeks to ensure resolution, otherwise referral to thoracic surgery.
- Lung abscess (consider in cavitating lung lesion)
  - Treatment for 3-7 weeks reported in previous review studies.
  - Repeat chest imaging q2-3 weeks until shows a small, stable residual lesion or is clear
- Aspiration pneumonia NOT an indication for anaerobic coverage as per IDSA guidelines.

### Antibiotic options:

- Metronidazole 500mg PO/IV q8h
- Clavulin 875/125mg PO q12h
- Piptazo 3.375g IV q6h

# Corticosteroids for pneumonia

Anat Stern [1], Keren Skalsky, Tomer Avni, Elena Carrara, Leonard Leibovici, Mical Paul

Affiliations + expand

PMID: 29236286 PMCID: PMC6486210 DOI: 10.1002/14651858.CD007720.pub3

## Abstract

**Background:** Pneumonia is a common and potentially serious illness. Corticosteroids have been suggested for the treatment of different types of infection, however their role in the treatment of pneumonia remains unclear. This is an update of a review published in 2011.

**Objectives:** To assess the efficacy and safety of corticosteroids in the treatment of pneumonia.

**Search methods:** We searched the Cochrane Acute Respiratory Infections Group's Specialised Register, CENTRAL, MEDLINE, Embase, and LILACS on 3 March 2017, together with relevant conference proceedings and references of identified trials. We also searched three trials registers for ongoing and unpublished trials.

**Selection criteria:** We included randomised controlled trials (RCTs) that assessed systemic corticosteroid therapy, given as adjunct to antibiotic treatment, versus placebo or no corticosteroids for adults and children with pneumonia.

**Data collection and analysis:** We used standard methodological procedures expected by Cochrane. Two review authors independently assessed risk of bias and extracted data. We contacted study authors for additional information. We estimated risk ratios (RR) with 95% confidence intervals (CI) and pooled data using the Mantel-Haenszel fixed-effect model when possible.

**Main results:** We included 17 RCTs comprising a total of 2264 participants; 13 RCTs included 1954 adult participants, and four RCTs included 310 children. This update included 12 new studies, excluded one previously included study, and excluded five new trials. One trial awaits classification.All trials limited inclusion to inpatients with community-acquired pneumonia (CAP), with or without healthcare-associated pneumonia (HCAP). We assessed the risk of selection bias and attrition bias as low or unclear overall. We assessed performance bias risk as low for nine trials, unclear for one trial, and high for seven trials. We assessed reporting bias risk as low for three trials and high for the remaining 14 trials.Corticosteroids significantly reduced mortality in adults with severe pneumonia (RR 0.58, 95% CI 0.40 to 0.84; moderate-quality evidence), but not in adults with non-severe pneumonia (RR 0.95, 95% CI 0.45 to 2.00). Early clinical failure rates (defined as death from any cause, radiographic progression, or clinical instability at day 5 to 8) were significantly reduced with corticosteroids in people with severe and non-severe pneumonia (RR 0.32, 95% CI 0.15 to 0.7; and RR 0.68, 95% CI 0.56 to 0.83, respectively; high-quality evidence). Corstocosteroids reduced time to clinical cure, length of hospital and intensive care unit stays, development of respiratory failure or shock not present at pneumonia onset, and rates of pneumonia complications.Among children with bacterial pneumonia, corticosteroids reduced early clinical failure rates (defined as for adults, RR 0.41, 95% CI 0.24 to 0.70; high-quality evidence) based on two small, clinically heterogeneous trials, and reduced time to clinical cure.Hyperglycaemia was significantly more common in adults treated with corticosteroids (RR 1.72, 95% CI 1.38 to 2.14). There were no significant differences between corticosteroid-treated people and controls for other adverse events or secondary infections (RR 1.19, 95% CI 0.73 to 1.93).

**Authors' conclusions:** Corticosteroid therapy reduced mortality and morbidity in adults with severe CAP; the number needed to treat for an additional beneficial outcome was 18 patients (95% CI 12 to 49) to prevent one death. Corticosteroid therapy reduced morbidity, but not mortality, for adults and children with non-severe CAP. Corticosteroid therapy was associated with more adverse events, especially hyperglycaemia, but the harms did not seem to outweigh the benefits.



Meta-Analysis > J Gen Intern Med. 2023 Aug;38(11):2593-2606. doi: 10.1007/s11606-023-08203-6. Epub 2023 Apr 19.

# Corticosteroids in Community-Acquired Bacterial Pneumonia: a Systematic Review, Pairwise and Dose-Response Meta-Analysis

Tyler Pitre [1], Daniyal Abdali [1], Dipayan Chaudhuri [1], Stephen M Pastores [2], Andrea M Nei [3], Djillali Annane [4], Bram Rochwerg [1 5], Dena Zeraatkar [5 6]

Affiliations + expand

PMID: 37076606 PMCID: PMC10115386 DOI: 10.1007/s11606-023-08203-6

## Abstract

**Introduction:** International guidelines provide heterogenous guidance on use of corticosteroids for community-acquired pneumonia (CAP).

**Methods:** We performed a systematic review of randomized controlled trials examining corticosteroids in hospitalized adult patients with suspected or probable CAP. We performed a pairwise and dose-response meta-analysis using the restricted maximum likelihood (REML) heterogeneity estimator. We assessed the certainty of the evidence using GRADE methodology and the credibility of subgroups using the ICEMAN tool.

**Results:** We identified 18 eligible studies that included 4661 patients. Corticosteroids probably reduce mortality in more severe CAP (RR 0.62 [95% CI 0.45 to 0.85]; moderate certainty) with possibly no effect in less severe CAP (RR 1.08 [95% CI 0.83 to 1.42]; low certainty). We found a non-linear dose-response relationship between corticosteroids and mortality, suggesting an optimal dose of approximately 6 mg of dexamethasone (or equivalent) for a duration of therapy of 7 days (RR 0.44 [95% 0.30 to 0.66]). Corticosteroids probably reduce the risk of requiring invasive mechanical ventilation (RR 0.56 [95% CI 0.42 to 74] and probably reduce intensive care unit (ICU) admission (RR 0.65 [95% CI 0.43 to 0.97]) (both moderate certainty). Corticosteroids may reduce the duration of hospitalization and ICU stay (both low certainty). Corticosteroids may increase the risk of hyperglycemia (RR 1.76 [95% CI 1.46 to 2.14]) (low certainty).

**Conclusion:** Moderate certainty evidence indicates that corticosteroids reduce mortality in patients with more severe CAP, the need for invasive mechanical ventilation, and ICU admission.



## Conflict of interest statement

TP, DC, SMP, AMN, DN, and BR are members of the Society of Critical Care Medicine Corticosteroid Guidelines Focused Update Panel. SMP is the co-Chair of the Society of Critical Care Medicine Corticosteroid Guidelines Focused Update Panel. SMP discloses personal fees for advisory board work from AbbVie, royalty fees from McGraw Hill as textbook editor, and institutional grant support from the National Cancer Institute of the National Institutes of Health under Award Number P30CA008748, ReviImmune, BioMerieux, and the Breast Cancer Research Foundation, outside the submitted work. No other authors made any disclosures.

Meta-Analysis > Eur J Med Res. 2025 Mar 28;30(1):215. doi: 10.1186/s40001-025-02487-6.

# Glucocorticoids can reduce mortality in patients with severe community-acquired pneumonia: a systematic review and meta-analysis of randomized controlled trials

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Affiliations + expand

PMID: 40148914 PMCID: PMC11951802 DOI: 10.1186/s40001-025-02487-6

## Abstract

**Background:** Severe community-acquired pneumonia (sCAP) is associated with higher morbidity and mortality. The use of glucocorticoids to improve the prognosis of severe community-acquired pneumonia remains a topic of controversy.

**Methods:** Following the guidelines given in the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA), we conducted a systematic review and meta-analysis to evaluate the effects of glucocorticoids on mortality and duration of mechanical ventilation in patients with sCAP. Randomized controlled studies investigating the use of glucocorticoids in the treatment of sCAP were extracted from PubMed, Embase, Cochrane Library, and Web of Science. Statistical analysis was performed to compare the differences in in-hospital mortality, mechanical ventilation duration, gastrointestinal bleeding, secondary infection, and other outcome measures between the glucocorticoid group and the control group.

**Results:** A total of 8 studies involving 1769 patients were included in the analysis. The hospital mortality in the glucocorticoid group was significantly lower than that in the control group [8 studies, relative risk (RR) 0.59; 95% CI 0.47-0.76, $p < 0.01$. $I^2 = 25\%$, low certainty]. The duration of mechanical ventilation in the glucocorticoid group was significantly shorter than that in the control group [Mean Difference (MD) -3.08; 95% CI -4.96 to -1.19, $p < 0.01$; $I^2 = 0\%$, low certainty]. There was no significant difference in the incidence of gastrointestinal bleeding (RR 0.94; 95% CI 0.55-1.63, $p = 0.84$, $I^2 = 0\%$, low certainty) or secondary infection (RR 0.85; 95% CI 0.58-1.25, $p = 0.85$, $I^2 = 2\%$, moderate certainty) between the glucocorticoid group and the control group. In subgroup analysis, mortality was significantly lower in the hydrocortisone group compared to the control group (6.3% vs. 14.6%, RR 0.43; 95% CI 0.29-0.62, $p < 0.01$, $I^2 = 0\%$, very low certainty). However, there was no significant difference in mortality between the methylprednisolone group and the control group (15.6% vs. 19.9%, RR 0.78; 95% CI 0.57-1.08, $p = 0.14$, $I^2 = 0\%$, moderate certainty).

**Conclusion:** Glucocorticoids can reduce mortality in patients with sCAP, and the effect may vary depending on the type and the dose of glucocorticoids used. Additionally, glucocorticoid treatment can lead to a shorter duration of mechanical ventilation, as well as the length of ICU stay, without increasing the risk of gastrointestinal bleeding or secondary infection in patients with sCAP. PROSPERO registration: CRD42023416525.

**Keywords:** Corticosteroids; Meta-analysis; Pneumonia; Severe community-acquired pneumonia.

# CAP Treatment - Corticosteroids

## Steroid regimen

- Hydrocortisone 50 mg IV q6hrs (may be preferred for patients in shock).
- Prednisone 50 mg PO daily.
- Methylprednisolone 40 mg IV daily.
- Dexamethasone 12 mg once, then 6 mg/day (either PO/IV).

## Steroid duration –

- Relatively short steroid duration is generally sufficient.
- In the CAPE-COD trial, steroid was tapered off within 8-14 days, depending on whether the patient was improving after four days.
- Additionally, steroid therapy was discontinued when patients left the ICU.

# CAP – Daily assessments

**TABLE 5: Daily Follow-up Stewardship Considerations for Hospitalized Patients with Community-acquired Pneumonia (CAP)‡**

| Assessment | Action |
|---|---|
| Confirm CAP diagnosis and assess clinical improvement | Review clinical progression to confirm CAP (viral or bacterial) diagnosis vs. non-infectious etiology |
| | Evaluate documented penicillin allergy as recommended by hospital guidelines. The evaluation may include history and physical examination, allergy consultation, challenge doses, or skin testing (refer to top of Table 4). |
| | Assess for clinical stability[15], at least 5 clinical stability criteria (or return to baseline) below:<br>• Tmax ≤38°C<br>• HR ≤100<br>• RR ≤24<br>• Arterial $O_2$ saturation ≥90% or $pO_2$ >60mmHg<br>• Baseline mental status<br>• SBP ≥90 mmHg |
| | Assess for CAP complications if no clinical improvement (secondary bacteremia, lung abscess, or empyema) |
| Diagnostic Testing | Determine pathogen-directed therapy based on sputum culture (if sputum can be readily produced) and other diagnostic testing |
| | Viral diagnostics: Consider discontinuing antibiotic therapy if, viral diagnostics are positive, Procalcitonin <0.25 (or 80% reduction on repeat testing in 72 hours), WBC < 10,000 cells/µl, and low suspicion for bacterial co-infection |
| | MRSA nasal swab:<br>• If negative, discontinue MRSA coverage (>95% negative predictive value in CAP)<br>• If positive, may not be indicative of MRSA pneumonia (<40% positive predictive value); continue assessment of other MRSA risk factors and consider anti-MRSA therapy discontinuation if no risk factors |
| Treatment Considerations | Try to minimize broad spectrum antibiotics when possible |
| | Assess for adverse drug events |
| Discharge Considerations | Assess for clinical stability; patient afebrile with at least 5 signs of CAP stability criteria listed above or return to baseline |
| | Assess for ability to tolerate oral therapy, oral de-escalation options:<br>• No MDRO risk factors (choose one):<br>» Amoxicillin (500mg) + clavulanate (125mg) PO TID, or Amoxicillin (875 mg or 2000mg) + clavulanate (125mg) PO BID<br>» Cefpodoxime 200mg PO BID<br>» Cefuroxime 500mg PO BID<br>• MDRO Risk Factors:<br>» Levofloxacin 750mg PO q24h<br>» If Legionella-negative or alternative etiology identified, discontinue azithromycin after 1500mg total. |
| | Consider duration of antibiotics administered (no more than 3-5 days total in the ED and inpatient) if clinically stable by day 3.[16]‡ |
| | Ensure post-discharge follow-up including insurance coverage and availability at outpatient pharmacy |
| | Consider vaccination (pneumococcal, influenza, COVID-19, and RSV [in eligible populations]). If relevant, provide smoking cessation counselling/medications and ensure patient is on proper therapy to enhance control of chronic conditions (e.g., COPD, CHF)" |
| | Educate patients and caregivers[17]:<br>• Planned antibiotic course (if needed) and instructions for follow-up medical care<br>• Signs and symptoms of worsening infection, and sepsis<br>• Signs and symptoms of antibiotic-associated adverse events, including *Clostridioides difficile* infection |

‡ This is a clinical practice enhancement to the ATS/IDSA CAP clinical practice guideline

# Non-resolving pneumonia

Review of etiologies, diagnosis, and approach to management

# Non-resolving pneumonia: Definition

**Usual duration of findings in treated community-acquired pneumonia**

| Abnormality | Duration (days) |
|---|---|
| Tachycardia and hypotension | 2 |
| Fever, tachypnea, and hypoxia | 3 |
| Cough | 14 |
| Fatigue | 14 |
| Infiltrates on chest radiograph | 30 |

*References:*

1. *Marrie TJ, Beecroft MD, Herman-Gnjidic Z. Resolution of symptoms in patients with community-acquired pneumonia treated on an ambulatory basis. J Infect 2004; 49:302.*
2. *Metlay JP, Atlas SJ, Borowsky LH, Singer DE. Time course of symptom resolution in patients with community-acquired pneumonia. Respir Med 1998; 92:1137.*
3. *Fine MJ, Stone RA, Singer DE, et al. Processes and outcomes of care for patients with community-acquired pneumonia: results from the Pneumonia Patient Outcomes Research Team (PORT) cohort study. Arch Intern Med 1999; 159:970.*

Graphic 74599 Version 2.0

# Non-resolving pneumonia: Definition

Rate of resolution will be affected by patient's underlying host factors, comorbidities, severity of illness, and suspected pathogen.

In stable or slowly improving pneumonia, especially in the presence of comorbidities or host factors that are known to delay the resolution of pneumonia, careful observation with or without therapy is warranted for four to eight weeks.

If there is no resolution or progression of disease, a more aggressive diagnostic approach is appropriate

| Condition | Effects |
|---|---|
| Chronic obstructive pulmonary disease | Impaired cough and mucociliary clearance |
| Alcohol use disorder | Aspiration, malnutrition, impaired neutrophil function |
| Neurologic disease | Aspiration, impaired clearance of secretions and cough |
| Heart failure | Edema fluid, impaired lymphatic drainage |
| Chronic kidney disease | Hypocomplementemia, impaired macrophage and neutrophil function, reduced humoral immunity |
| Malignancy | Impaired immune function, altered colonization, effects of chemotherapy |
| Human immunodeficiency virus | Impaired cell-mediated and humoral immunity |
| Diabetes mellitus | Impaired neutrophil function and cell-mediated immunity |

Graphic 62007 Version 2.0



# Non-resolving pneumonia: Underlying diseases prolonging typical CAP or causing recurrence

# Non-resolving pneumonia: Complications from initial CAP causing non-responsiveness

- Empyema
  - More likely to be younger and to use illicit drugs.
  - Most common cultured pathogen was Streptococcus milleri, suggesting a role for aspiration
  - Demonstration of any significant amount of pleural fluid should prompt consideration of a diagnostic thoracentesis to rule out empyema
- Lung Abscess
  - Major pathogens are from upper airway - Peptostreptococcus spp, Bacteroides melaninogenicus, and Fusobacterium nucleatum
  - Often subtle in onset and relatively slow in progression. Typically present with fever, night sweats, weight loss, cough, dyspnea, and putrid sputum with or without pleurisy.
  - Predisposing factors that should raise the suspicion of abscess formation include alcoholism, seizures, poor oral hygiene, and previous aspiration.
  - Chest radiography typically demonstrates an air-liquid level in a dependent segment (posterior segment of an upper lobe or posterior segment of a lower lobe), but chest CT is more sensitive and can confirm the diagnosis in difficult cases.
  - Most patients with lung abscess do well with conservative management and a prolonged course of antibiotics.
- ARDS

# Non-resolving pneumonia: Infectious Etiologies

| Pathogen (related disease) | Populations at risk |
|---|---|
| *Mycobacterium tuberculosis* (tuberculosis) | Older adults, immigrants, HIV positive |
| Nontuberculous mycobacteria (bronchiectasis) | Chronic obstructive pulmonary disease, HIV positive |
| *Nocardia* spp (nocardiosis) | Immunocompromised host |
| *Actinomyces israelii* (actinomycosis) | Aspiration risk, chest wall involvement |
| *Aspergillus* spp (aspergillosis) | Immunocompromised host, evidence of vascular invasion |
| Endemic fungi: | |
| *Histoplasma capsulatum* (histoplasmosis) | Mississippi River Valley |
| *Coccidioides immitis* (coccidioidomycosis) | Southwestern United States |
| *Blastomyces dermatitidis* (blastomycosis) | Southeast and Midwest United States |
| *Coxiella burnetii* (Q fever) | Exposure to cats, cattle, or sheep |
| *Francisella tularensis* (tularemia) | Exposure to rabbits or ticks |
| *Chlamydia psittaci* (psittacosis) | Avian sources |
| *Yersinia pestis* (plague) | Exposure to rats |
| *Leptospira interrogans* (leptospirosis) | Exposure to rats |
| *Burkholderia pseudomallei* (melioidosis) | Southeast Asia (rodent exposure), mimics tuberculosis |
| *Paragonimus westermani* (paragonimiasis) | Asia/Africa/Central and South America |
| Hantavirus | Southwestern United States with exposure to mice |
| *Bacillus anthracis* (anthrax) | More common in Asia Minor, Iran, Turkey, Greece, South Africa; contact with infected animal carcasses or hides |

Graphic 78779 Version 6.0

**Tuberculosis**

- **Clues**:
- Longer duration of symptoms.
- History of night sweats, weight loss, or hemoptysis.
- Epidemiologic risk factors for tuberculosis.
- Radiology showing cavitation, upper lobe involvement, or absence of air bronchograms. (30838060)
- **Diagnostic tests**:
- A CT scan may help risk-stratify the likelihood of TB.
- Sputum for AFB smear/culture and TB PCR.
- Bronchoscopy

**PJP (Pneumocystis jiroveci pneumonia)**

- **Clues**:
- HIV (if the diagnosis is known).
- Non-HIV: Chronic steroid use (>15 mg prednisone for >3 weeks), chemotherapy/immunosuppressive drugs.
- Diffuse interstitial infiltrates.
- **Diagnostic tests**:
- HIV serology is crucial to the diagnosis of HIV-PJP.
- Serum beta-D-glucan.
- Induced sputum for PJP PCR.
- Bronchoscopy

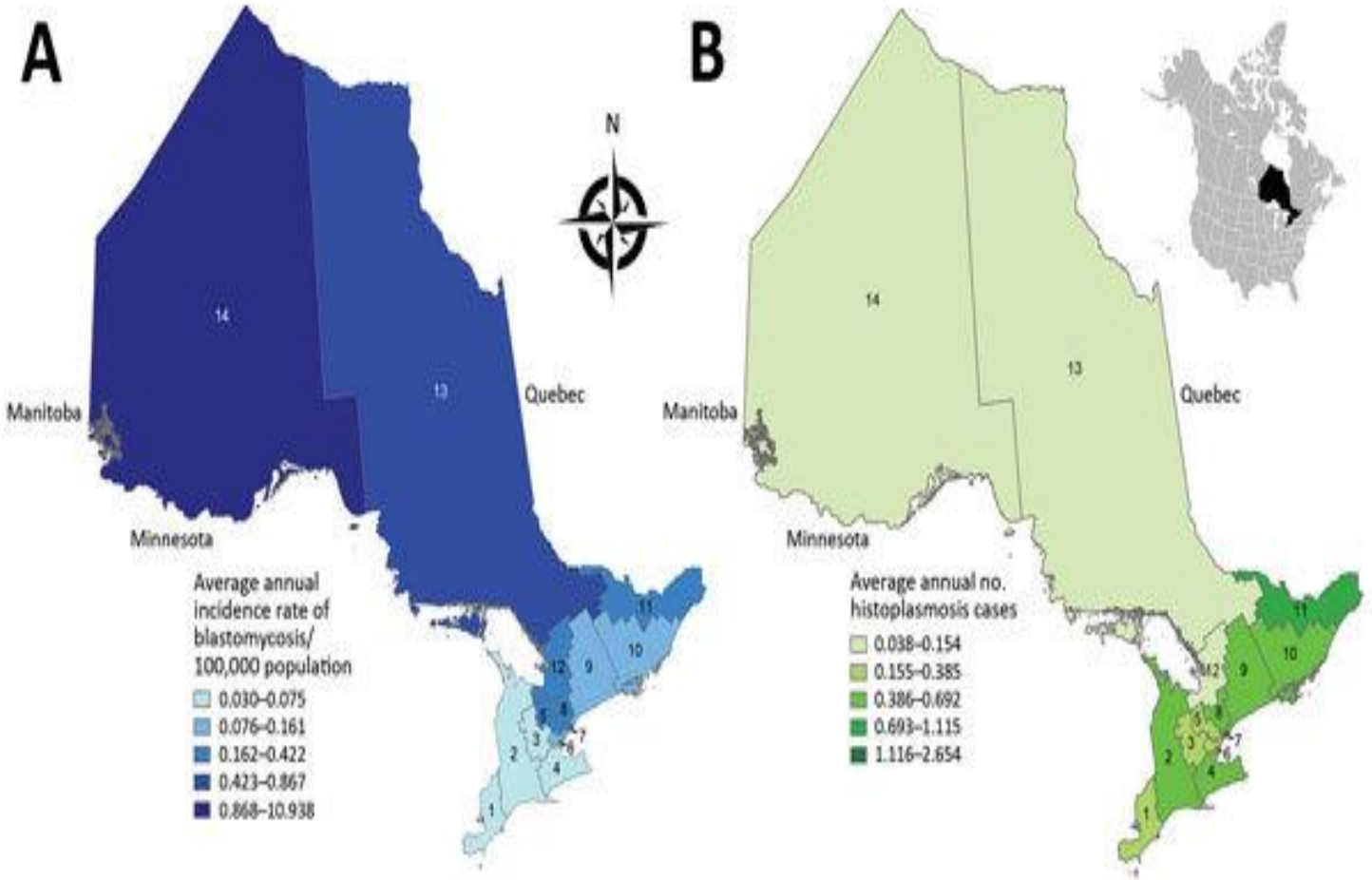
**Invasive aspergillosis**

- **Clues**:
- Neutropenia (especially >10 days).
- High-dose steroid (e.g., pulse therapy for vasculitis).
- **Diagnostic tests**:
- A CT scan may help risk-stratify the likelihood of invasive aspergillus.
- Beta-D-Glucan, galactomannan.
- Bronchoscopy.

**Endemic fungal pneumonia or cryptococcus**

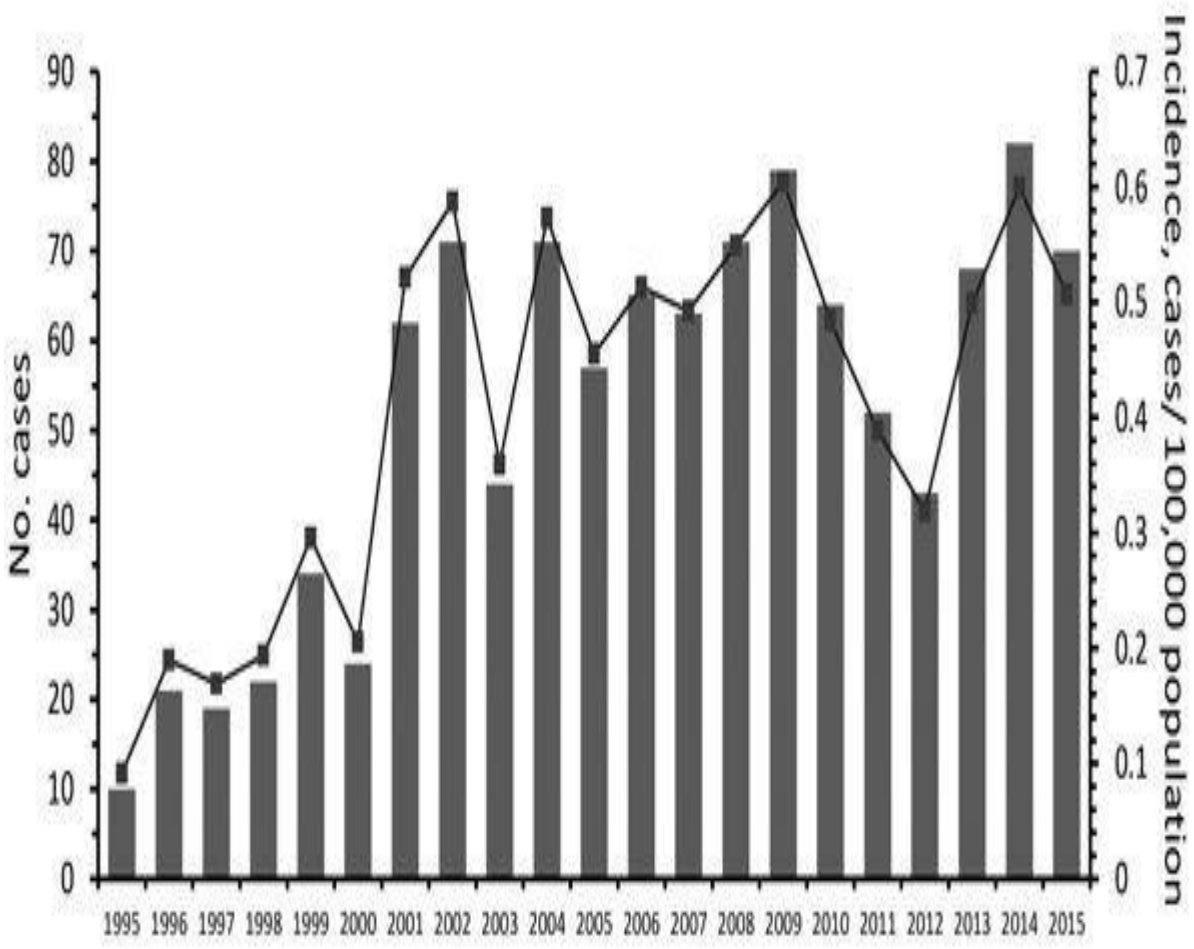
- **Clues**:
- Often more *indolent* than bacterial pneumonia.
- Radiologic pattern is often nodular.
- Can affect normal hosts (blastomycosis), but often affects immunocompromised patients (esp: TNF-inhibitors & steroids).
- Exposure to endemic locations, bird/bat droppings (histoplasmosis), and soil exposure (blastomycosis, coccidiomycosis).
- **Diagnostic tests**:
- Urine antigens (e.g., blastomycosis, histoplasmosis).
- Serum antigen for Cryptococcus (CrAg).
- The CT scan can be suggestive.
- Bronchoscopy.

# Incidence of endemic fungi in Ontario

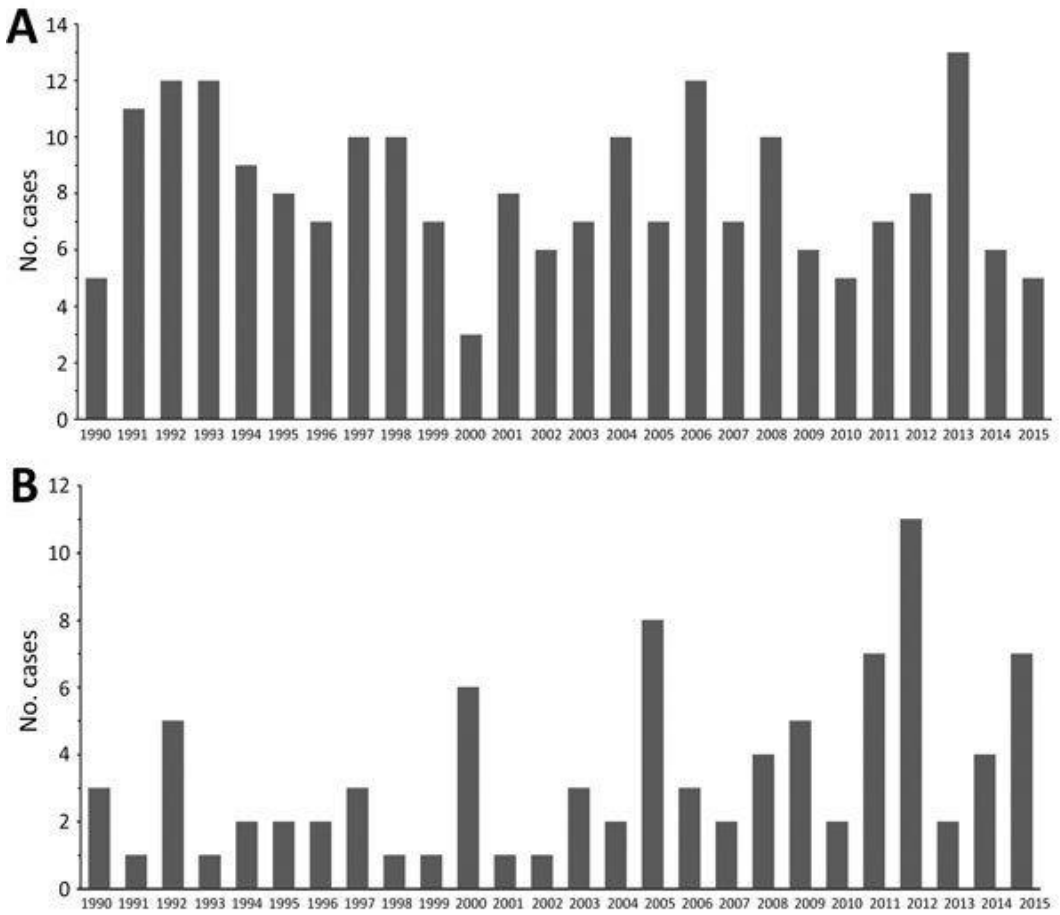



- Brown et al. 2018

# Endemic Fungi Incidence in Ontario




- Blastomycosis




A = Histoplasmosis
B = Coccidioidomycosis

# Non-resolving pneumonia: Non-Infectious Etiologies

| |
|---|
| **Neoplastic disorders** |
| Bronchogenic carcinoma |
| Lymphoma |
| **Immunologic disorders** |
| Vasculitis: |
| Granulomatosis with polyangiitis |
| Diffuse alveolar hemorrhage |
| Cryptogenic organizing pneumonia |
| Eosinophilic pneumonia syndromes |
| Acute eosinophilic pneumonia |
| Chronic eosinophilic pneumonia |
| Acute interstitial pneumonia |
| Pulmonary alveolar proteinosis |
| Sarcoidosis |
| Rheumatic diseases (eg, systemic lupus erythematosus, rheumatoid arthritis, polymyositis/dermatomyositis) |
| **Drug toxicity** |
| **Pulmonary vascular abnormalities** |
| Heart failure |
| Pulmonary embolism |

**DAH (diffuse alveolar hemorrhage)**

- **Clues**:
- Hemoptysis (only 50% of patients, however).
- Diffuse infiltrates.
- Renal failure or active urinary sediment (hematuria).
- Falling hemoglobin.
- May have previously been diagnosed with rheumatologic disease.
- **Diagnostic tests**:
- Urinalysis: hematuria.
- Markedly elevated ESR & CRP.
- Bronchoscopy shows alveolar hemorrhage.
- Serologies can be helpful (e.g., ANCA).

**AEP (acute eosinophilic pneumonia)**

- **Clues**:
- Blood eosinophils over ~300/uL (unusual for severe pneumonia).
- Younger adults with severe PNA often require intubation.
- Sometimes inhalational exposure (especially recent-onset smoking).
- **Diagnostic tests**:
- Bronchoscopy shows alveolar eosinophilia.

**OP (organizing pneumonia)**

- **Clues**:
- Onset is more indolent than usual PNA.
- Weight loss often occurs.
- Refractory to antibiotics.
- Radiographic features may be suggestive (e.g., perilobular opacities, migratory opacities).
- **Diagnostic tests**:
- Hard to diagnose (tissue biopsy needed).

**Drug- or radiation-induced pneumonitis**

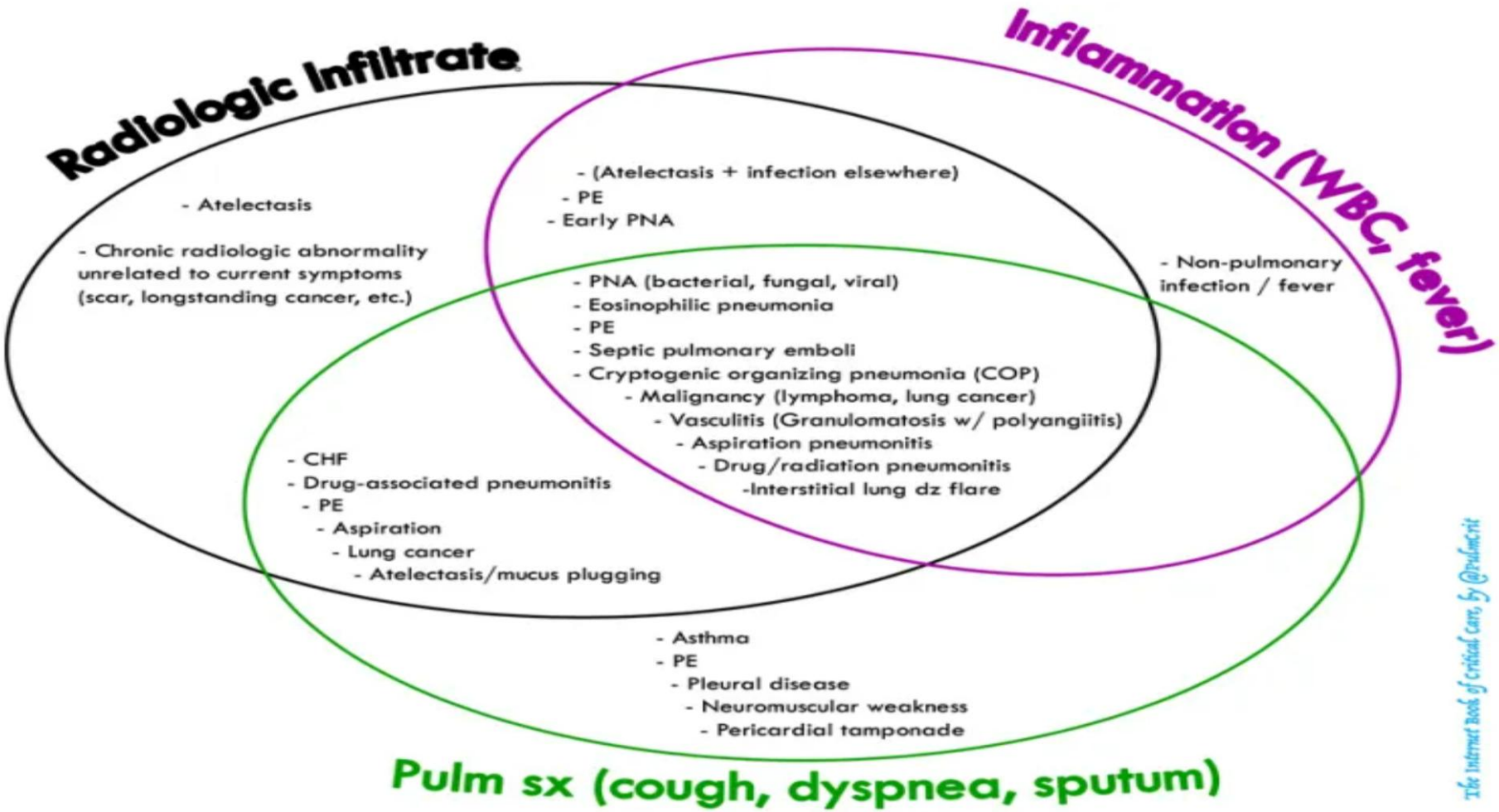
- **Clues**:
- Exposure to a drug implicated in causing pneumonitis.
- Most often: amiodarone, chemotherapeutics.
- **Diagnostic tests**:
- Hard to diagnose.
- Often, diagnosis of exclusion, treated empirically.
- Radiation pneumonitis may have a focal, non-anatomic distribution corresponding to the radiation field.

# Non-resolving pneumonia in patients on biologics

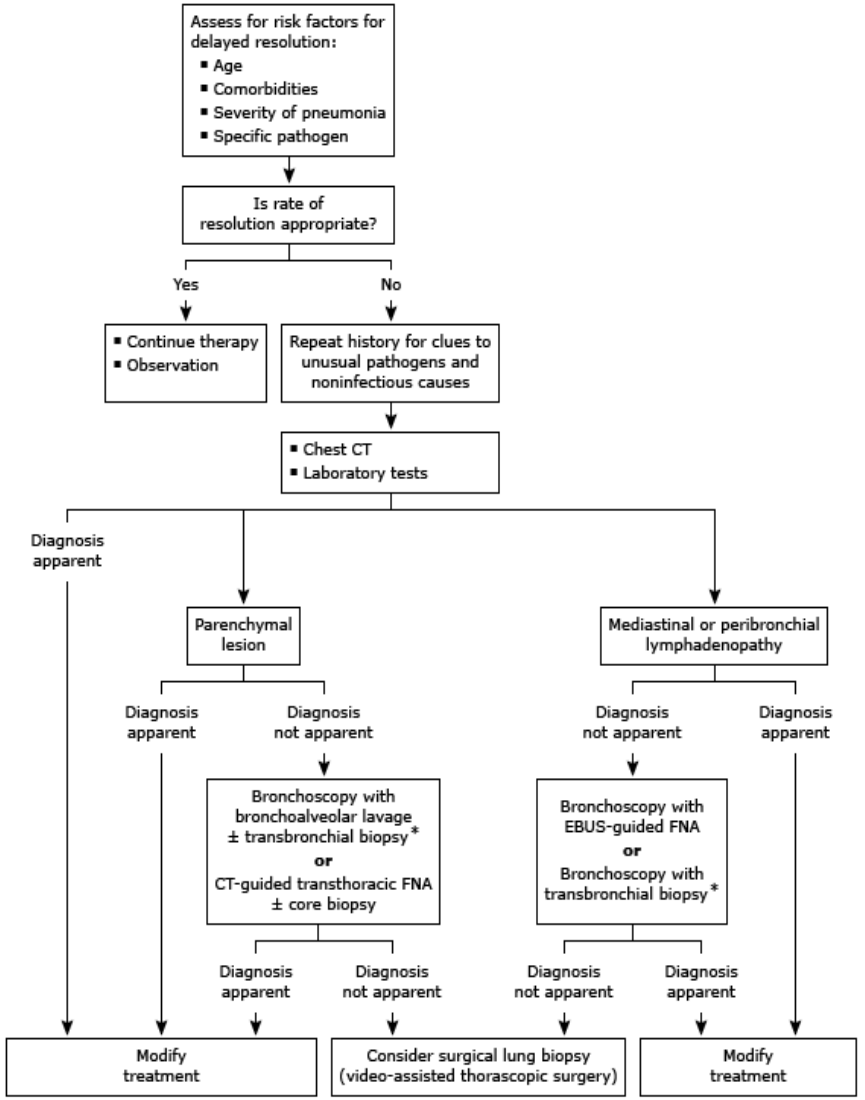
**Pulmonary diseases associated with immunomodulatory agents**

| Drug class | Drug | Complications |
|---|---|---|
| **TNF-alpha inhibitors** | **Etanercept** | **Infectious** |
| | | *Streptococcus pneumoniae* |
| | | Histoplasmosis |
| | | Tuberculosis |
| | | **Noninfectious** |
| | | Systemic lupus erythematosus pleural disease |
| | | Pulmonary fibrosis |
| | | Granulomatous inflammation |
| | | Pneumonitis |
| | | Exacerbation of interstitial disease |
| | **Infliximab** | **Infectious** |
| | | Tuberculosis |
| | | Bovine tuberculosis |
| | | Cryptococcosis |
| | | Histoplasmosis |
| | | Legionellosis |
| | | Invasive and allergic aspergillosis |
| | | *Scedosporium* infection |
| | | Actinomycosis |
| | | *Pneumocystis jirovecii* |
| | | Coccidioidomycosis |
| | | **Noninfectious** |
| | | Langerhans cell histiocytosis |
| | | Drug-induced alveolitis |
| | | Systemic lupus erythematosus pleural or parenchymal disease |
| | | Sarcoidosis |
| | | Interstitial pneumonitis |
| | | Diffuse alveolar hemorrhage |
| | | Fibrosing alveolitis |
| | **Adalimumab** | **Infectious** |
| | | Tuberculosis |
| | | Aspergillosis |
| | | **Noninfectious** |
| | | Pulmonary fibrosis |
| **IL-1 inhibitor** | **Anakinra** | **Infectious** |
| | | Tuberculosis |
| **Costimulation blockade** | **Abatacept** | **Infectious** |
| | | Bacterial pneumonia |
| **B-cell depletion** | **Rituximab** | **Noninfectious** |
| | | Interstitial pneumonitis |
| | | Pulmonary fibrosis |

# Non-resolving pneumonia: Confirm triad



# Non-resolving pneumonia: An Approach to work up




CT: computed tomography; EBUS: endobronchial ultrasound; FNA: fine needle aspiration.

* For those with localized disease, image-guided bronchoscopic techniques such as robotic bronchoscopy or navigational bronchoscopy may improve the diagnostic yield of transbronchial biopsy.

# Non-resolving pneumonia: Conventional CT Chest

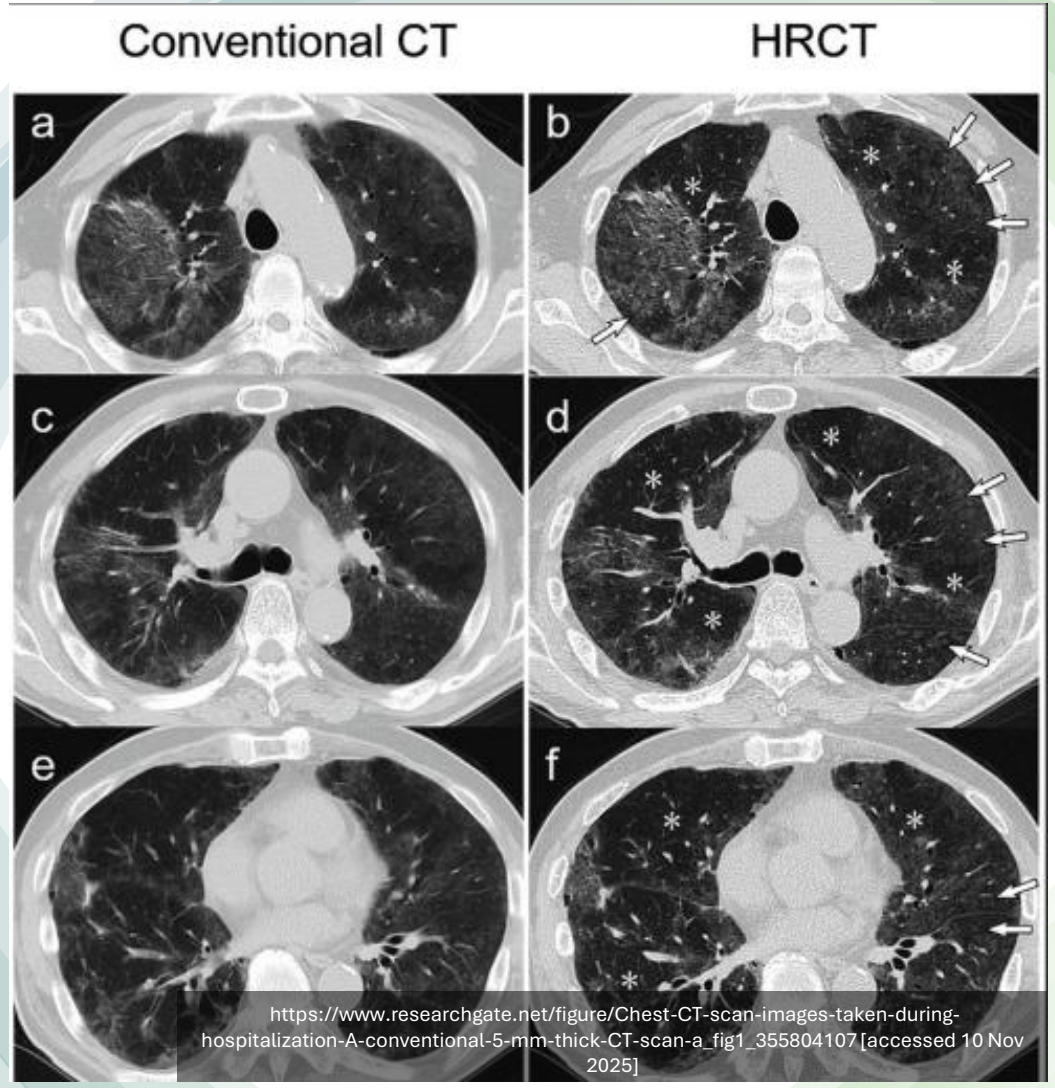
**CT scan to assist the diagnosis of pneumonia**

- Some patients with pneumonia will have a negative radiograph with a positive CT scan. Causes of reduced sensitivity of radiograph include: (Murray 2022)
  - Underlying structural lung disease (e.g., emphysema, bullae).
  - Severe obesity.
  - Neutropenia.
  - Very early in the disease course.
- CT scan can be especially helpful to detect pneumonia in patients with chronic lung disease and chronically abnormal radiograph (especially if a prior CT scan is available for comparison).
- Evidence supports the use of CT scan for pneumonia diagnosis:
  - One series found that a *third* of patients with suspected pneumonia and a negative radiograph had infiltrates detected by CT scan. These radiograph-negative, CT-positive patients had outcomes similar to patients with infiltrates on radiography, substantiating that these are "real" pneumonias detected on CT scan.(26168322)
  - Among 188 patients with infiltrates detected on radiograph, pneumonia was excluded by chest CT scan in nearly a third of patients. Prompt exclusion of pneumonia facilitates antibiotic stewardship and (more importantly) redirection of attention to the actual cause of the patient's illness.(26168322)
- 💡 Among patients who are older and unlikely to harmed by radiation, there should probably be a reduced threshold to obtain CT scan to facilitate prompt diagnosis and accurate therapy.

https://emcrit.org/ibcc/cap/#differential_diagnosis

# Non-resolving pneumonia: High-resolution CT Chest (HRCT)

- HRCT uses thin-section slices (typically 1–2 mm thickness) and a high-spatial-frequency reconstruction algorithm, which enhances the visualization of fine lung structures such as the secondary pulmonary lobule, interlobular septa, and small airways.
- Conventional CT typically uses thicker slices (5–10 mm), which are adequate for general thoracic imaging (e.g., masses, nodules, pleural disease) but lack the spatial resolution needed for subtle parenchymal abnormalities.
- Compared with conventional chest radiography, high-resolution chest CT allows superior detection of underlying parenchymal abnormalities, including emphysema, airspace disease, interstitial disease, and nodules.
- Such findings may narrow the differential diagnosis or suggest reasons for resolution failure.



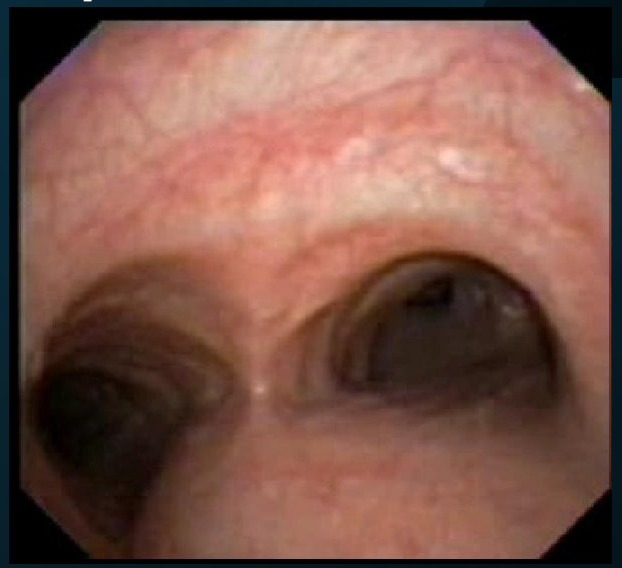

https://www.researchgate.net/figure/Chest-CT-scan-images-taken-during-hospitalization-A-conventional-5-mm-thick-CT-scan-a_fig1_355804107 [accessed 10 Nov 2025]

# Bronchoscopy in work up of non-resolving pneumonias

Bronchoscopy with bronchoalveolar lavage and transbronchial biopsy can successfully diagnose approximately 90 percent of patients who eventually have a specific diagnosis established.

Most likely to be useful in younger nonsmoking patients with multilobar involvement and prolonged disease, whereas older adult patients, smokers, and those with immunodeficiency are more likely to have a nondiagnostic bronchoscopy and to have a slowly resolving pneumonia.

# Bronchoscopy in work up of non-resolving pneumonias

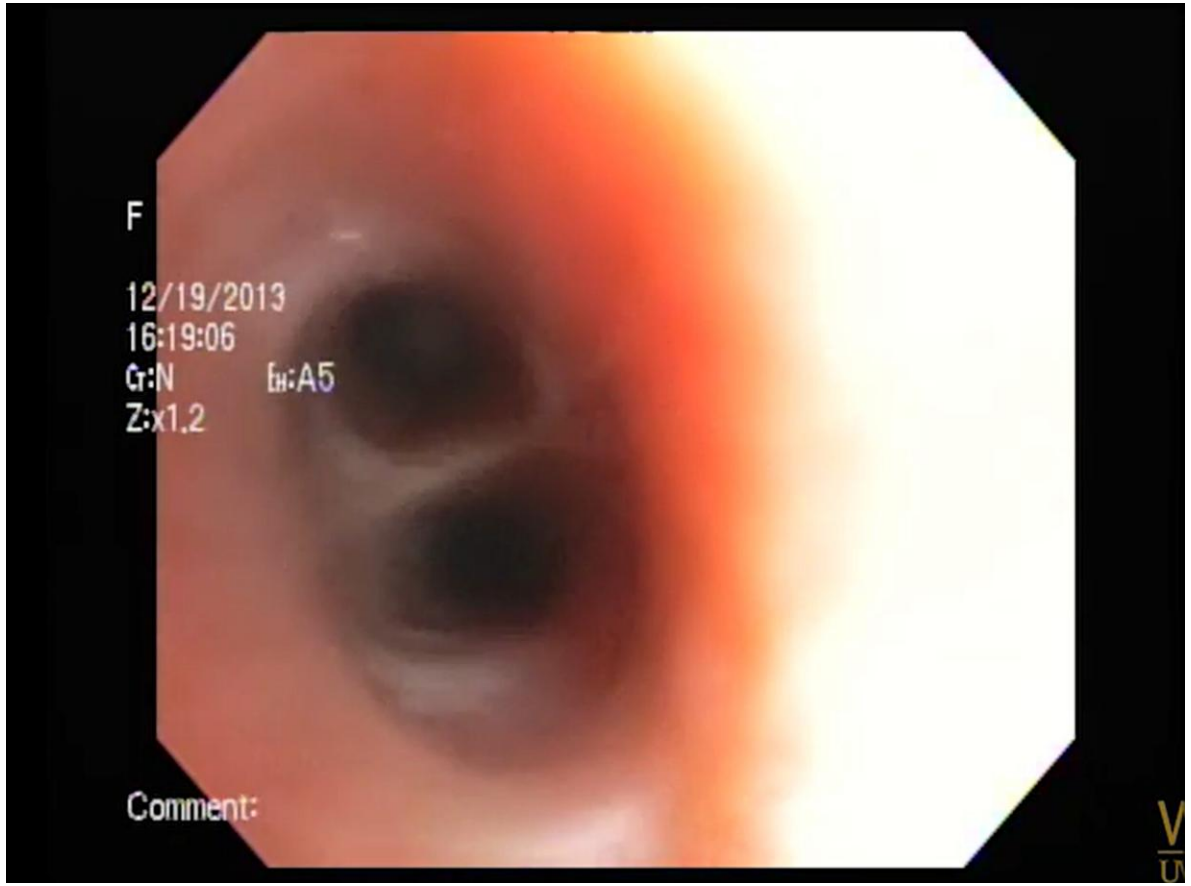


Bronchoscopy sampling is particularly useful to exclude mycobacteria or fungi if not detected with expectorated sputum.

Bronchoalveolar lavage may be helpful in identifying noninfectious causes of nonresolving pneumonia, such as acute or chronic eosinophilic pneumonia.

For patients with concomitant mediastinal lymphadenopathy endobronchial ultrasound-guided transbronchial needle aspiration may facilitate the diagnosis of granulomatous disease or malignancy

# Bronchoscopy in work up of non-resolving pneumonias: Bronchiolar Lavage Diagnostic Features




**Diagnostic features of bronchoalveolar lavage in interstitial lung disease**

| Disease category | Examples | Findings in BAL fluid |
|---|---|---|
| Malignancy | Lymphangitic carcinomatosis | Malignant cells |
| | Bronchioloalveolar cell carcinoma | Malignant cells |
| | Pulmonary lymphoma | Malignant cells |
| Diseases due to inhaled (exogenous) material | Lipoid pneumonia | Fat globules in macrophages (oil-red-O-stain) |
| | | Multinucleated giant cells |
| | Asbestosis | Ferruginous bodies |
| | Silicosis | Dust particles seen by polarized microscopy |
| | Berylliosis | Positive lymphocyte transformation test to beryllium salts |
| Inflammatory | Diffuse alveolar hemorrhage | Large numbers of erythrocytes |
| | | Hemosiderin-laden macrophages (iron stain) |
| | | Sequential lavages progressively more hemorrhagic |
| | Chronic eosinophilic pneumonia | Eosinophils ≥40 percent |
| | Idiopathic acute eosinophilic pneumonia | Eosinophils ≥25 percent |
| | Pulmonary alveolar proteinosis | Lipoproteinaceous material (periodic acid-Schiff stain) |
| | Pulmonary Langerhans cell histiocytosis (Histiocytosis X) | Monoclonal antibody (T6) positive histiocytes |
| | | CD1 positive Langerhans cells >5 percent |
| | | Birbeck granules in lavaged macrophages (seen by electron microscopy) |

**Bronchoalveolar lavage: common cellular patterns in selected diseases**

| | Lymph | Neutro | Eosino | Mast cells | Other features |
|---|---|---|---|---|---|
| **Inflammatory diseases** | | | | | |
| IPF | + | +++ | + | N | |
| PF-CTD | + | + | + | N | Increased lymphocytes in early disease |
| Cryptogenic organizing pneumonia | + | + | + | +/- | Foamy macrophages; mixed pattern of increased cells characteristic; decreased CD4:CD8 ratio |
| Eosinophilic pneumonia | + | N | ++++ | | |
| Asbestosis | N | ++ | + | N | Ferruginous bodies |
| Silica-exposed | +/- | N | N | N | Dust particles by polarized light microscopy |
| Coal workers' pneumoconiosis | + | + | N | N | |
| Aluminum potroom workers | N | N | N | ? | + LTT |
| **Granulomatous diseases** | | | | | |
| Sarcoidosis | ++ | N or + | N | N | CD4/CD8 ≥2 |
| Hypersensitivity pneumonitis | +++ | N or + | N | + | CD4/CD8 <1 |
| Chronic beryllium disease | +++ | N or + | N | N | + LTT to beryllium salts |

+: increase; N: normal values; lymph: lymphocytes; neutro: neutrophils; eosino: eosinophils; IPF: idiopathic pulmonary fibrosis; PF-CTD: pulmonary fibrosis associated with connective tissue disease; LTT: lymphocyte transformation test.

# Bronchoscopy in work up of non-resolving pneumonias:
# Bronchiolar Lavage Cellular Patterns

**Interstitial lung disease associated with BAL eosinophilia**

| |
|---|
| **High count (≥25 percent)** |
| Chronic eosinophilic pneumonia (≥40 percent) |
| Eosinophilic granulomatosis with polyangiitis (EGPA; Churg Strauss) and active pneumonitis (≥30 percent) |
| Idiopathic acute eosinophilic pneumonia (≥25 percent) |
| Tropical pulmonary eosinophilia (40 to 70 percent) |
| **Mild to moderate counts (<25 percent)** |
| Connective tissue disease |
| Drug-induced pneumonitis (eg, due to NSAIDs, cocaine, nitrofurantoin, minocycline, sulfonamides, ampicillin, and others) |
| Fungal pneumonia |
| Idiopathic pulmonary fibrosis (<10 percent) |
| Pulmonary Langerhans cell histiocytosis |
| Sarcoidosis |

BAL: bronchoalveolar lavage; NSAIDs: Nonsteroidal anti-inflammatory drugs.

Graphic 64886 Version 3.0



**Interstitial lung disease associated with BAL neutrophilia**

| |
|---|
| Idiopathic pulmonary fibrosis (15 to 40 percent) |
| Cryptogenic organizing pneumonia (40 to 70 percent) |
| Inorganic dust diseases |
| Asbestosis |
| Silicosis |
| Cigarette smoking (<10 percent) |
| Pulmonary Langerhans cell histiocytosis (Histiocytosis X) |
| Hypersensitivity pneumonitis (acute) |
| Sarcoidosis (advanced) |

BAL: bronchoalveolar lavage.

Graphic 76619 Version 2.0



**Interstitial lung disease associated with BAL lymphocytosis**

| |
|---|
| Hypersensitivity pneumonitis (60 to 80 percent) |
| Sarcoidosis (Acute - 40 to 60 percent) |
| Idiopathic pulmonary fibrosis (15 to 30 percent) |
| Berylliosis |
| Granite workers |
| Amiodarone pneumonitis |
| Lymphoma/Pseudolymphoma |
| Pulmonary Langerhans cell histiocytosis (Early) |

BAL: bronchoalveolar lavage.

Graphic 69908 Version 2.0



**CD4:CD8 T lymphocyte ratios in diseases presenting with lymphocytic alveolitis**

| CD4 : CD8 raised | CD4 : CD8 normal | CD4 : CD8 lowered |
|---|---|---|
| Sarcoidosis | Tuberculosis | Hypersensitivity pneumonitis |
| Berylliosis | Lymphangioleiomyomatosis | Silicosis |
| Asbestosis | | Drug induced |
| Crohn's disease | | BOOP |
| Rheumatoid arthritis | | HIV infection |

*Redrawn from Poulter LW, Rossi GA, Bjermer L, et al, Eur Respir Rev 1992; 2:75.*

# Bronchoscopy in work up of non-resolving pneumonias: Bronchiolar Lavage Cellular Patters

# Bronchoscopy: Other Indications

**Indications for bronchoscopy**

| |
|---|
| **Inspection** |
| Cough (persistent, unexplained) |
| Hemoptysis |
| Wheeze (localized/fixed) |
| Diaphragmatic paralysis* |
| Unexplained hoarseness and/or vocal cord paralysis/stridor |
| Suspected tracheo-esophageal fistula |
| Chest trauma |
| Suspected tracheomalacia |
| Toxic inhalation or burn injury |
| Verify tracheostomy or endotracheal tube placement |
| Evaluate precancerous lesions (autofluorescence) |
| Donor transplant lung evaluation |
| **May require biopsy, BAL, or other procedure** |
| Focal/unilateral hyperinflation or hyperlucency |
| Localization of broncho-pleural fistula |
| Atelectasis (persistent) |
| Abnormal chest radiograph |
| Pleural effusion¶ |
| Paratracheal/mediastinal/hilar mass |
| Parenchymal mass/nodule |
| Diagnosis of etiology of pneumonia |
| Recurrent/nonresolving (imunocompetent host) |
| Nosocomial |
| Immunocompromised host |
| Foreign body in airway (known or suspected) |
| Evaluation for rejection in lung transplant recipient |
| Delivery of brachytherapy |
| Research |

* Utility/yield for this indication are controversial.
¶ Diagnostic yield ≥40 percent only when effusion is massive or associated with hemoptysis, mass, or atelectasis.

# Bronchoscopy contraindications

- **Severe hypoxemia**
  - Severe hypoxemia defined as $SpO_2$ <90 percent while receiving $FiO_2$ ≥60 percent.
  - If the treatment decision is felt to significantly depend on the results of the bronchoscopy or if it is considered to be therapeutic (eg, mucus plug removal), bronchoscopy may be performed either on noninvasive ventilation (NIV) with the informed consent clearly stating the risk of impending respiratory failure.
  - Alternatively, bronchoscopy can be performed after elective intubation with the attendant complications of intubation and mechanical ventilation clearly outlined to the patient.
- **Unstable or severe obstructive airways disease**
  - Bronchoscopy to obtain bronchoalveolar lavage or transbronchial lung biopsy is usually safe in patients with stable obstructive airways disease (eg, asthma, chronic obstructive pulmonary disease [COPD], bronchiectasis).
  - However, there is a potential for bronchospasm and/or drop in $FEV_1$ or FVC in patients with severe asthma or COPD
  - Premedication with nebulized bronchodilator and optimization of asthma control can minimize the risks of bronchospasm or hypoxia. Patients may benefit from CPAP or positive pressure ventilation during recovery from sedation.
- **Hemodynamic instability and myocardial ischemia**
- **Severe pulmonary hypertension**
- **Uncorrected bleeding diathesis**
  - In patients with thrombocytopenia )50,000/$mm^3$, the risk of bleeding may be unacceptably high, especially if biopsy is considered.
  - The British Thoracic Society (BTS) guidelines suggest that bronchoscopy with bronchoalveolar lavage may be performed safely in those with platelet counts of 20,000/$mm^3$Nonemergent elective bronchoscopy should be avoided in patients who are currently having or have had any of the following events within the past six weeks: Myocardial ischemia (ie, unstable angina, Myocardial infarction [MI], Decompensated heart failure, Exacerbation of asthma or chronic obstructive pulmonary disease, Life-threatening cardiac arrhythmias.

# Thoracic / Open Lung Biopsy

Several factors need to be considered when deciding to proceed to a more invasive biopsy procedure, such as thoracoscopic or open lung biopsy.

A previous nondiagnostic bronchoscopy, concern about the specific patient's risk or ability to tolerate bronchoscopy, or the need for obtaining larger specimens of tissue for certain diagnoses may all support the need for proceeding to thoracoscopic or open lung biopsy

# RVH HOSPITAL COURSE - BRONCHOSCOPY

- Transferred to RVH on 10/18/2025 for bronchoscopy
  - No evidence of purulent secretions.
  - BAL microbiology (October 18, 2025):
    - No bacterial growth, AFB stain negative and culture pending
    - Fungal stain and culture negative
    - Galactomannan 0.13 (normal)
  - BAL cell counts predominant neutrophilia

Name of Procedure
Flexible bronchoscopy, bronchial lavage
Details of Procedure
Date: October 18, 2025

Pre-Procedure Diagnosis: Rule out atypical infection
Post-Procedure Diagnosis: Unremarkable airways with scant secretions

Clinical Information
Mr. Kelsie is a 53-year-old man admitted to ICU with respiratory failure in the context of an abnormal CT scan

Pre-Procedure Respiratory Status
Intubated and ventilated

Anesthesia
Fentanyl infusion
Propofol infusion
Midazolam 3 mg IV x 1

Procedure Note
Approach: By endotracheal tube
Vocal Cords: Not applicable
Trachea: Portion visualized is unremarkable

Carina: Sharp
Right Bronchial Tree: Unremarkable, normal mucosa
Left Bronchial Tree: Unremarkable, normal mucosa
Secretions: Scant secretions

Samples Obtained
Bronchoalveolar Lavage (BAL): LLL, LUL, RLL, RUL

Investigations
Microbiology: Galactomannan assay, bacterial culture and sensitivity, AFB stain culture, fungal stain and culture
Cytology: Rule out malignancy, PJP
Cell count and differential

Bleeding/Complications
None

Post-Procedure Care
Standard ICU care

# BAL INFECTIOUS WORK UP

Test: Culture | Last Updated: 20 Oct 2025 12:16

OLIS Full Report

**Microbiology**

**Specimen Type**
Source, Unspecified

**Site Modifier**
Bronchoalveolar lavage - Left Lower Lobe

**Collection Date/Time**
18 Oct 2025 14:01:00 EDT

**Specimen Collected By**
Royal Victoria Hospital Laboratory (Lab 4179)

## Respiratory Culture

Microscopic; Gram Stain
Result: Bacteria: None seen

Microscopic; Gram Stain
Result: Pus cells: Present

Culture
Result: NO GROWTH AFTER 2 DAYS

Test: Culture | Last Updated: 05 Nov 2025 14:55

OLIS Full Report

Royal Victoria Hospital Laboratory (Lab 4179)

## Mycobacteria Culture (preliminary)

Culture Findings (Preliminary)
Result: Mycobacterial culture: Pending

Culture Findings (Preliminary)
Result: Fluor. stain of concentrt: No Acid-fast Bacilli seen

## Fungal Culture (amended)

Culture
Result: Fungal Microscopy: No fungal elements seen

Culture (Amended)
Result: Fungus culture: No fungus grown

Culture
Result: Note: No Fungus isolated at 2 weeks.

Incubation will continue, and you will be notified of any late-growing fungus types. Late outgrowth is rare, however, and this will normally be your Final Report.

# BAL PATHOLOGY AND CELL DIFFERENTIAL

**Interstitial lung disease associated with BAL neutrophilia**

| |
|---|
| Idiopathic pulmonary fibrosis (15 to 40 percent) |
| Cryptogenic organizing pneumonia (40 to 70 percent) |
| Inorganic dust diseases |
| Asbestosis |
| Silicosis |
| Cigarette smoking (<10 percent) |
| Pulmonary Langerhans cell histiocytosis (Histiocytosis X) |
| Hypersensitivity pneumonitis (acute) |
| Sarcoidosis (advanced) |

BAL: bronchoalveolar lavage.

Graphic 76619 Version 2.0



Pathologist Review 21 Oct 2025 20:36

OLIS Full Report

**Specimen Type**
Body fluid

**Collection Date/Time**
18 Oct 2025 14:01:00 EDT

**Specimen Collected By**
Royal Victoria Hospital Laboratory (Lab 4179)

## Fluid Analysis

| Name | Result |
|---|---|
| Fluid Type<br>Result: BRONCHIAL LAVAGE | |
| Clarity | Clear |
| Colour; Fluid | Colourless |
| Neutrophils/100 Leukocytes; Fluid; Manual | 0.53 |
| Lymphocytes/100 Leukocytes; Fld; Manual | 0.21 |
| Monocytes/100 Leukocytes; Fluid; Manual | 0.01 |
| Eosinophils/100 Leukocytes; Fluid | 0.00 |
| Basophils/100 Leukocytes; Fluid; Manual | 0.00 |
| Other Cells/100 WBC; Body fld | 0.25 |
| Other cells includes macrophages and mesothelial cells. (Royal Victoria Hospital Laboratory) (Lab 4179) | |
| Technologist Comment | . |

# RVH HOSPITAL COURSE - BRONCHOSCOPY

- After the bronchoscopy he was treated with pulsed dose steroids for total of 72 hours
- A few days later he was extubated but remained dependent on supplemental oxygen
- Underwent CT-guided biopsy was performed On October 30, 2025, which was non-diagnostic
- Transferred to Southlake Oct 30, 2025 for an open lung biopsy which was performed a day later

# REPEAT ECHO

Height: 74 in  Weight: 187 lb  BSA: 2.1 m2
HR (bpm): 58  Heart Rhythm: Sinus
Reason For Study: Dyspnea

INTERPRETATION SUMMARY
1. Normal biventricular size and systolic function.
2. No significant valvular dysfunction.
3. No evidence of intracardiac shunt with agitated saline injection both supine and sitting.

PROCEDURE
Technically complete echocardiographic examination (including appropriate spectral/tissue Doppler, color flow Doppler, M-Mode interrogation) with suboptimal quality. Suboptimal technical quality due to limited patient mobility. An agitated saline injection study was performed to assess for cardiac shunting. The injection of agitated saline was performed through an intravenous line in the left arm.

# CT GUIDED BIOPSY

Site Of Origin 27 Oct 2025 14:16

OLIS Full Report

**Specimen Collected By**
Royal Victoria Hospital Laboratory (Lab 4179)

## Surgical Pathology

Relevant History
Result: R/O VASCULITIS

Site Of Origin
Result: A: BX Body Tissue Any Site, RIGHT LUNG TISSUE

Gross Description
Result: The specimen is received in one part.
A. The specimen, received in formalin, labeled with the patient's identification, Vantage tag and "A RT lung BX", consists of 2 cores of white tissue (2-11 mm).
Entirely submitted: A1-2
24/10/25 1443 /CC

Final Diagnosis
Result: Right lung, core biopsy:
* Negative for malignancy
* Focal and minimal parenchymal inflammation and associated interstitial fibrosis only
5/nm

Provider; Signing
Result: Signed by: MACNEILL,KAREN NICOLE MD 27/10/2025

# OPEN LUNG BIOPSY

Relevant History

Result: None Provided

Final Diagnosis

Result: ***PRELIMINARY DIAGNOSIS***

A. B. C. E. Lung, wedge, right upper lobe, right middle lobe, right lower, right lower lobe # 2, wedge resections:

-Organizing pneumonia, extensive fibrosis with honeycombing - Pending expert consultation

-Negative for malignancy

D.Visceral pleura, right, biopsy:

-Mesothelium with acute inflammation (history of chest tube insertion) - Pending expert consultation

Comment:

Final diagnosis pending. Sent for expert consultation to Sunnybrook Health Sciences Center. Please expect supplementary report

This case was reviewed at intradepartmental consensus round and the above interpretation reflects the consensus opinion.

R/I: CR (Nov 4, 2025)

# Organizing Pneumonia: Histopathology

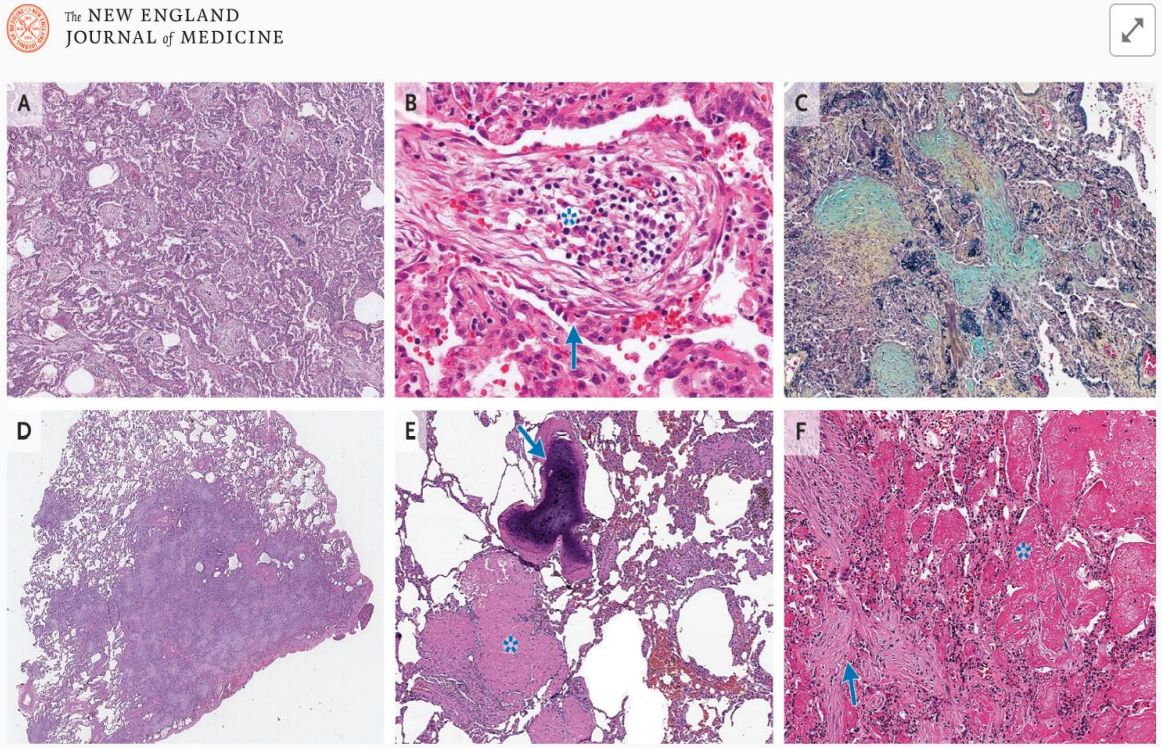



**Figure 3.** Histopathological Features of COP.

Cryptogenic Organizing Pneumonia. N Engl J Med. March 16, 2022.



**Histologic features of organizing pneumonia pattern**

| Key histologic features |
|---|
| Organizing pneumonia: intraluminal organizing fibrosis in distal airspaces (bronchioles, alveolar ducts, and alveoli) |
| Patchy and peribronchiolar distribution |
| Preservation of lung architecture |
| Uniform and recent temporal appearance |
| Mild interstitial chronic inflammation (eg, lymphocytes and edema) |
| Foamy macrophages are common in alveolar spaces, likely due to bronchiolar obstruction |
| **Pertinent negative findings** |
| Absence of severe fibrotic changes (eg, honeycombing); incidental scars or apical fibrosis may be present |
| Granulomas are absent; giant cells are rare or absent |
| Lack of prominent infiltration of eosinophils or neutrophils |
| Absence of necrosis or abscess |
| Absence of vasculitis |
| Lack of hyaline membranes or prominent airspace fibrin* |

* Intra-alveolar fibrin deposition is seen in acute fibrinous and organizing pneumonia; it is unclear whether this is a separate entity or a variant of organizing pneumonia.

Graphic 60654 Version 5.0

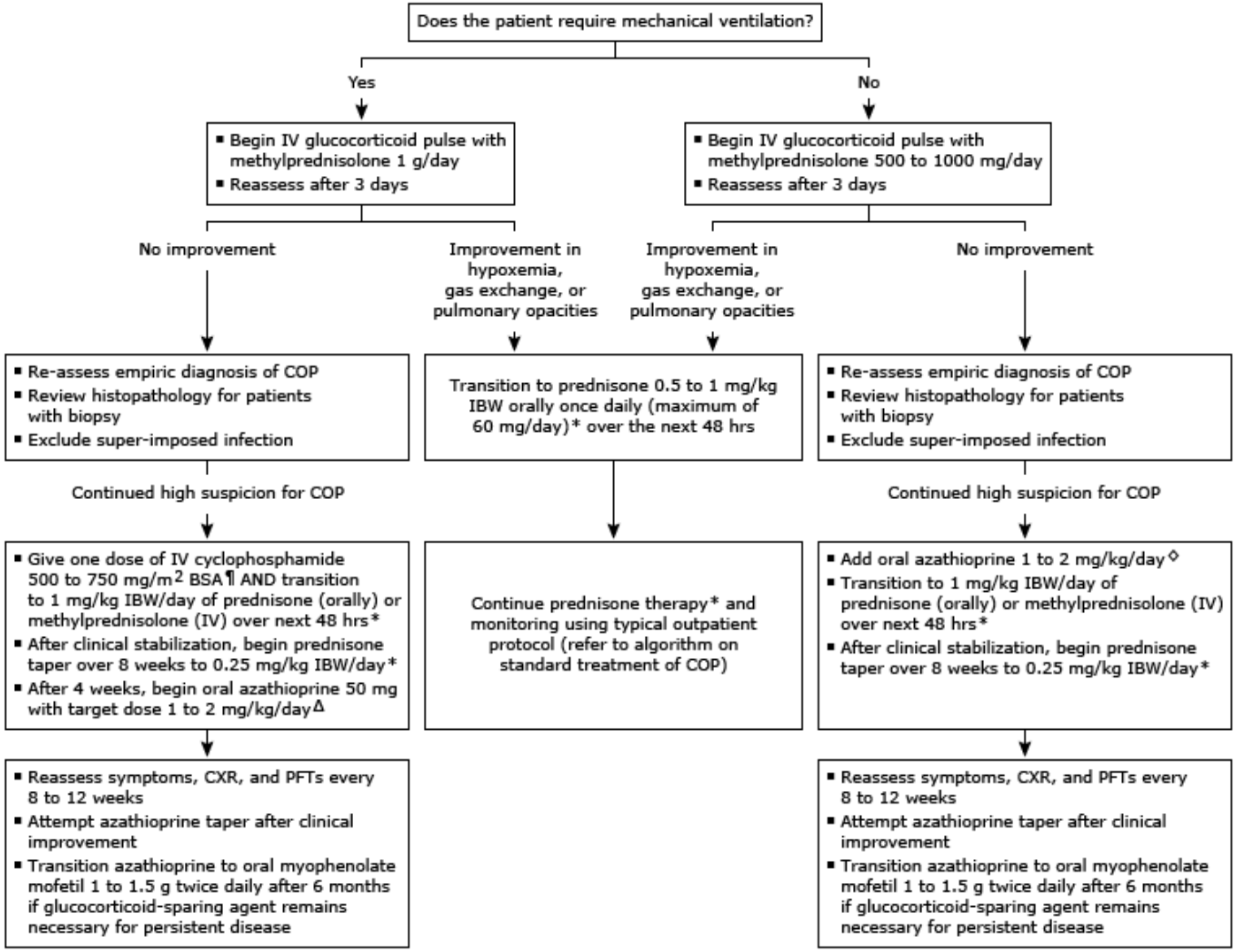
# Organizing Pneumonia: Secondary Causes

**Table 1. Causes of Secondary Organizing Pneumonia.***

| |
|---|
| Infection |
| Bacteria: *Burkholderia cepacia*, *Chlamydia pneumoniae*, *Coxiella burnetii*, *Legionella pneumophila*, *Mycoplasma pneumoniae*, *Nocardia asteroides*, *Pseudomonas aeruginosa*, *Serratia marcescens*, *Staphylococcus aureus*, *Streptococcus pneumoniae* |
| Viruses: adenovirus, SARS-CoV-2, cytomegalovirus, herpesvirus, HIV, influenza virus, parainfluenza virus, HHV-7, RSV |
| Parasites: *Plasmodium vivax*, *Dirofilaria immitis* |
| Fungi: aspergillus, *Cryptococcus neoformans*, *Penicillium janthinellum*, *Pneumocystis jirovecii* |
| Drugs: amiodarone, nitrofurantoin, bleomycin, methotrexate, freebase cocaine |
| Connective-tissue disease: rheumatoid arthritis, Sjögren's syndrome, polymyositis or dermatomyositis, systemic sclerosis, antisynthetase syndrome, vasculitis |
| Hematologic cancer: leukemia, lymphoma |
| Transplantation: lung, liver, bone marrow |
| Radiation injury from breast cancer treatment |
| Common variable immunodeficiency |
| Association with other interstitial lung diseases: eosinophilic pneumonia, hypersensitivity pneumonitis, organizing diffuse alveolar damage, usual interstitial pneumonia |
| Inflammatory bowel disease: Crohn's disease, ulcerative colitis |
| Miscellaneous causes |
| Reaction to other lung processes: abscess, diffuse alveolar hemorrhage, airway obstruction |
| Inhalation injury: aspiration, aerosolized textile dye, mustard gas |

* Information on secondary causes is from Cottin and Cordier,[5] Lohr et al.,[6] Boots et al.,[7] Chang et al.,[8] Barroso et al.,[9] Sveinsson et al.,[10] Drakopanagiotakis et al.,[11] and Wang et al.[12] HHV-7 denotes human herpesvirus 7, HIV human immunodeficiency virus, RSV respiratory syncytial virus, and SARS-CoV-2 severe acute respiratory syndrome coronavirus 2.

# Cryptogenic Organizing Pneumonia (COP): Treatment



# Platypnea orthodeoxia syndrome (POS)

POS is defined by positional dyspnea and arterial desaturation that worsen in the upright position and improve when supine.

The pathophysiology of POS requires both an anatomical substrate (such as an intracardiac or intrapulmonary shunt) and a functional component that promotes right-to-left shunting or severe ventilation-perfusion (V/Q) mismatch in the upright position.

Organizing pneumonia, whether cryptogenic or secondary, can cause extensive parenchymal consolidation, particularly in the lower lung zones.

- This can result in significant V/Q mismatch, especially when gravitational redistribution of pulmonary blood flow in the upright position increases perfusion to poorly ventilated, consolidated basal lung regions, thereby exacerbating hypoxemia and manifesting as POS.

While most cases of POS are due to intracardiac shunts, the medical literature recognizes severe parenchymal lung disease, including organizing pneumonia, as a potential extracardiac cause through the mechanism of positional V/Q mismatch and intrapulmonary shunting

## Platypnea-orthodeoxia Syndrome: An Important Cause of Morbidity in Post Coronavirus Disease Patients

Divendu Bhushan [1,✉], Vijay Kumar [2], B Hilbert Sahoo [3], Aniketh Hegde [4]

▸ Author information ▸ Copyright and License information

PMCID: PMC9015920 PMID: 35519923

### Abstract

Platypnea-orthdeoxia syndrome (POS) is a clinical scenario where patient get breathless while sitting or standing. Its important causes are cardiac shunts, hepatopulmonary syndrome and pulmonary ventilation perfusion mismatch. During this pandemic as cases of pulmonary fibrosis increased, we find POS as one of the important cause of morbidity during recovery. Early recognition of this will decrease the morbidity and unrealistic expectation of fast recovery.

How to cite this article

Bhushan D, Kumar V, Sahoo BH, Hegde A. Platypnea-orthodeoxia Syndrome: An Important Cause of Morbidity in Post Coronavirus Disease Patients. Indian J Crit Care Med 2022;26(3):401–402.

**Keywords:** Happy hypoxia, Platypnea, Pulmonary fibrosis

## Reversible platypnea-orthodeoxia in COVID-19 acute respiratory distress syndrome survivors

Geak Poh Tan [1], Sharlene Ho [2], Bingwen Eugene Fan [3], Sanjay H Chotirmall [4], Cher Heng Tan [5], Sennen Jin Wen Lew [6], Po Ying Chia [7], Barnaby E Young [8], John Arputhan Abisheganaden [9], Ser Hon Puah [10]

Affiliations + expand

PMID: 32777268 PMCID: PMC7413098 DOI: 10.1016/j.resp.2020.103515

### Abstract

Platypnea-orthodeoxia syndrome (POS) is a rare clinical syndrome characterized by orthostatic oxygen desaturation and positional dyspnea from supine to an upright position. We observed POS in 5 of 20 cases of severe 2019 novel coronavirus (COVID-19) pneumonia, which demonstrated persistently elevated shunt fraction even after liberation from mechanical ventilation. POS was first observed during physiotherapy sessions; median oxygen desaturation was 8 % (range: 8-12 %). Affected individuals were older (median 64 vs 53 years old, $p = 0.05$) and had lower body mass index (median 24.7 vs 27.6 kg/m$^2$, $p = 0.03$) compared to those without POS. While POS caused alarm and reduced tolerance to therapy, this phenomenon resolved over a median of 17 days with improvement of parenchymal disease. The mechanisms of POS are likely due to gravitational redistribution of pulmonary blood flow resulting in increased basal physiological shunting and upper zone dead space ventilation due to the predominantly basal distribution of consolidative change and reported vasculoplegia and microthrombi in severe COVID-19 disease.

**Keywords:** Coronavirus; Critical care; Pneumonia; Rehabilitation; Respiratory physiology.

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