Lung Cancer

Lung cancer is a leading cause of cancer-related mortality worldwide, characterized by malignant growths in the lung tissue that can lead to significant complications requiring hospital management. This guide provides physician assistant (PA) students with a comprehensive framework to understand the types, presentation, treatment, and hospital management of lung cancer complications, with case scenarios to apply the knowledge.

Introduction and Pathophysiology

Lung cancer arises from uncontrolled proliferation of epithelial cells in the lung, often driven by genetic mutations (e.g., EGFR, ALK, KRAS) and environmental exposures (e.g., smoking, radon). It is broadly classified into non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC), with distinct histopathological and clinical features.

Pathophysiology:

Oncogenic Mutations: Mutations in EGFR, ALK, or KRAS promote uncontrolled cell growth; smoking induces DNA damage (e.g., p53 mutations).

Tumor Growth: Masses obstruct airways, invade local structures (e.g., chest wall, mediastinum), and metastasize (e.g., brain, bones, liver).

Paraneoplastic Syndromes: Tumors produce hormones or cytokines (e.g., ACTH, PTHrP), causing systemic effects (e.g., Cushing's syndrome, hypercalcemia).

Complications: Local effects (e.g., obstruction, hemoptysis) and systemic effects (e.g., metastases, thrombosis) lead to acute decompensation, often requiring hospitalization.

Lung cancer management involves a multidisciplinary approach, with hospital care focusing on acute complications such as obstruction, infection, and oncologic emergencies.

Different Types of Lung Cancer

Non-Small Cell Lung Cancer (NSCLC, 85%):

Adenocarcinoma (40%): Most common, often peripheral, associated with EGFR/ALK mutations; more common in non-smokers and women.

Squamous Cell Carcinoma (25%): Central location, linked to smoking; often presents with cavitation, hemoptysis.

Large Cell Carcinoma (10%): Poorly differentiated, aggressive, often peripheral; rapid growth, early metastases.

Other Subtypes: Adenosquamous, sarcomatoid carcinoma (rare).

Small Cell Lung Cancer (SCLC, 15%):

Highly Aggressive: Central location, rapid doubling time, early metastases (e.g., brain, liver); strongly associated with smoking.

Neuroendocrine Features: Produces paraneoplastic syndromes (e.g., SIADH, Cushing's syndrome).

Other Types:

Carcinoid Tumors (1-2%): Neuroendocrine tumors; less aggressive, may cause carcinoid syndrome (flushing, diarrhea).

Mesothelioma: Rare, associated with asbestos exposure; affects pleura, not true lung cancer but often managed similarly.

Clinical Presentation

Pulmonary Symptoms:

Chronic cough, hemoptysis, dyspnea, chest pain (pleuritic or due to chest wall invasion).

Wheezing, stridor (airway obstruction), recurrent pneumonia (post-obstructive).

Systemic Symptoms:

Weight loss, fatigue, anorexia, fever (tumor necrosis or infection).

Paraneoplastic syndromes: Hypercalcemia (PTHrP, squamous cell), SIADH (hyponatremia, SCLC), Cushing's syndrome (ACTH, SCLC), hypertrophic osteoarthropathy (clubbing, NSCLC).

Metastatic Symptoms:

Brain: Headache, seizures, focal neurological deficits.

Bone: Pain, fractures (e.g., vertebrae, ribs).

Liver: Jaundice, hepatomegaly, elevated LFTs.

Adrenal: Often asymptomatic; detected on imaging.

Oncologic Emergencies:

Superior vena cava (SVC) syndrome: Facial swelling, dyspnea, venous distension (SCLC, central tumors).

Malignant pleural effusion: Dyspnea, pleural fluid (exudative, often hemorrhagic).

Pericardial effusion/tamponade: Dyspnea, hypotension, muffled heart sounds.

Treatment

Non-Small Cell Lung Cancer (NSCLC):

- Early Stage (I-II):
  - **Surgery:** Lobectomy or segmentectomy (preferred); video-assisted thoracoscopic surgery (VATS) reduces morbidity.
  - **Adjuvant Therapy:** Chemotherapy (e.g., cisplatin + vinorelbine) for stage II; consider radiation if margins positive.
- Locally Advanced (III):
  - **Chemoradiation:** Concurrent cisplatin/etoposide + radiation (60-66 Gy); improves survival.
  - **Immunotherapy:** Durvalumab (anti-PD-L1) consolidation for unresectable stage III post-chemoradiation.
- Metastatic (IV):
  - **Targeted Therapy:** EGFR mutations (osimertinib 80 mg PO daily), ALK rearrangements (alectinib 600 mg PO BID).
  - **Immunotherapy:** Pembrolizumab (anti-PD-1) 200 mg IV q3w if PD-L1 ≥1%; often combined with chemotherapy.
  - **Chemotherapy:** Platinum doublet (e.g., carboplatin + pemetrexed) for non-targetable mutations.
  - **Supportive:** Palliative radiation for symptomatic metastases (e.g., bone pain).

Small Cell Lung Cancer (SCLC):

- Limited Stage:
  - **Chemoradiation:** Cisplatin/etoposide + radiation (45-60 Gy); prophylactic cranial irradiation (PCI) if response.
- Extensive Stage:
  - **Chemotherapy:** Carboplatin + etoposide x 4-6 cycles; atezolizumab (anti-PD-L1) 1200 mg IV q3w maintenance.
  - **Palliative:** Radiation for symptomatic sites (e.g., brain mets, SVC syndrome).

Other Types:

Carcinoid: Surgery for localized disease; somatostatin analogs (e.g., octreotide) for carcinoid syndrome.

Mesothelioma: Chemotherapy (pemetrexed + cisplatin); surgery (e.g., extrapleural pneumonectomy) in select cases.

Hospital Management of Complications of Lung Cancer

Lung cancer patients often present to the hospital with complications requiring urgent management, including airway obstruction, infections, oncologic emergencies, and metastatic effects.

Airway Obstruction:

- **Presentation:** Dyspnea, stridor, wheezing; often central tumors (SCLC, squamous cell).
- **Management:**
  - **Bronchoscopy:** Endobronchial debulking (e.g., laser ablation, cryotherapy) to relieve obstruction.
  - **Stenting:** Airway stents for extrinsic compression (e.g., tumor mass effect).
  - **Radiation:** Palliative radiation (e.g., 30 Gy in 10 fractions) to shrink tumor.
  - **Supportive:** Oxygen, corticosteroids (e.g., dexamethasone 4-8 mg IV q6h) to reduce edema, bronchodilators (e.g., albuterol).

Post-Obstructive Pneumonia:

- **Presentation:** Fever, productive cough, dyspnea; consolidation distal to tumor.

- **Management:**
  - **Antibiotics:** Broad-spectrum (e.g., cefepime 2 g IV q8h + vancomycin 15 mg/kg IV q12h) to cover gram-negatives, MRSA; adjust based on cultures.
  - **Drainage:** Bronchoscopy to clear mucus plugs; consider chest tube if empyema.
  - **Supportive:** Oxygen, IV fluids, monitor for sepsis (e.g., lactate, blood cultures).

Superior Vena Cava (SVC) Syndrome:

- **Presentation:** Facial/neck swelling, dyspnea, JVD, collateral veins; often SCLC or NSCLC.
- **Management:**
  - **Elevate Head of Bed:** Reduces venous pressure.
  - **Steroids/Diuretics:** Dexamethasone 4-8 mg IV q6h, furosemide 40 mg IV to reduce edema (controversial efficacy).
  - **Endovascular Stenting:** Urgent stenting of SVC if severe symptoms (e.g., airway compromise).
  - **Radiation/Chemotherapy:** For tumor shrinkage (e.g., 20 Gy in 5 fractions for SCLC).
  - **Anticoagulation:** If thrombus present (e.g., heparin 80 units/kg IV bolus, then 18 units/kg/h).

Malignant Pleural Effusion:

- **Presentation:** Dyspnea, chest pain; pleural fluid (exudative, hemorrhagic).
- **Management:**
  - **Thoracentesis:** Diagnostic and therapeutic; remove 1-1.5 L to relieve dyspnea.
  - **Pleurodesis:** Talc slurry or doxycycline if recurrent; requires good lung re-expansion.
  - **Indwelling Pleural Catheter:** For outpatient management of recurrent effusions.
  - **Chemotherapy/Immunotherapy:** To reduce tumor burden (e.g., pembrolizumab for NSCLC with PD-L1 $\geq$1%).

Pericardial Effusion/Tamponade:

- **Presentation:** Dyspnea, hypotension, muffled heart sounds, pulsus paradoxus.

- **Management:**
  - **Pericardiocentesis:** Urgent drainage if tamponade (e.g., ECHO-guided, remove 50-100 mL initially).
  - **Pericardial Window:** Surgical option for recurrent effusion.
  - **Chemotherapy:** To address underlying malignancy (e.g., cisplatin/etoposide for SCLC).

Brain Metastases:

- **Presentation:** Headache, seizures, focal deficits (e.g., hemiparesis).
- **Management:**
  - **Steroids:** Dexamethasone 10 mg IV load, then 4 mg IV q6h to reduce edema.
  - **Anticonvulsants:** Levetiracetam 500 mg IV BID for seizures (prophylaxis controversial).
  - **Radiation:** Whole-brain radiation therapy (WBRT, 30 Gy in 10 fractions) or stereotactic radiosurgery (SRS) for 1-3 lesions.
  - **Surgery:** Resection for solitary, accessible lesions with good performance status.

Hypercalcemia:

- **Presentation:** Confusion, lethargy, polyuria, dehydration; calcium >10.5 mg/dL.
- **Management:**
  - **IV Fluids:** Normal saline 200-300 mL/h to correct dehydration, promote calciuresis.
  - **Bisphosphonates:** Zoledronic acid 4 mg IV over 15 minutes; reduces bone resorption.
  - **Calcitonin:** 4 IU/kg IM/SC q12h for rapid effect (bridges to bisphosphonates).
  - **Chemotherapy:** To target tumor (e.g., squamous cell NSCLC producing PTHrP).

Venous Thromboembolism (VTE):

- **Presentation:** DVT (leg swelling), PE (dyspnea, hypoxia); cancer increases risk 4-7x.
- **Management:**
  - **Anticoagulation:** LMWH (e.g., enoxaparin 1 mg/kg SC BID) preferred over warfarin in cancer; DOACs (e.g., apixaban 10 mg PO BID x 7 days, then 5 mg BID) alternative.

- **IVC Filter:** If anticoagulation contraindicated (e.g., active bleeding).
- **Supportive:** Oxygen, fluids for PE; monitor for bleeding (LMWH risk 3-5%).

Table: Common Complications of Lung Cancer and Hospital Management

Complication	Presentation	Management
Airway Obstruction	Dyspnea, stridor, wheezing	Bronchoscopy (debulking), stenting, radiation, steroids (dexamethasone 4-8 mg IV q6h)
Post-Obstructive Pneumonia	Fever, cough, dyspnea	Antibiotics (cefepime + vancomycin), bronchoscopy, oxygen, fluids
SVC Syndrome	Facial swelling, dyspnea, JVD	Elevate head, steroids, stenting, radiation, anticoagulation if thrombus
Malignant Pleural Effusion	Dyspnea, chest pain	Thoracentesis, pleurodesis, indwelling catheter, chemotherapy
Pericardial Effusion/ Tamponade	Dyspnea, hypotension, muffled sounds	Pericardiocentesis, pericardial window, chemotherapy
Brain Metastases	Headache, seizures, focal deficits	Steroids (dexamethasone 10 mg IV load), anticonvulsants, radiation (WBRT/SRS), surgery
Hypercalcemia	Confusion, lethargy, polyuria	IV fluids (NS 200-300 mL/h), zoledronic acid 4 mg IV, calcitonin, chemotherapy
VTE (DVT/PE)	Leg swelling, dyspnea, hypoxia	LMWH (enoxaparin 1 mg/kg SC BID), IVC filter if contraindicated, oxygen

Key Pearls

Types: NSCLC (adenocarcinoma, squamous, large cell), SCLC (aggressive, neuroendocrine), carcinoid (less aggressive).

Presentation: Cough, hemoptysis, dyspnea, weight loss; paraneoplastic (hypercalcemia, SIADH); metastases (brain, bone, liver).

Treatment: NSCLC (surgery, chemoradiation, targeted therapy, immunotherapy); SCLC (chemoradiation, PCI); supportive care for all.

Hospital Complications: Airway obstruction (bronchoscopy, stenting), pneumonia (antibiotics, drainage), SVC syndrome (stenting, radiation), effusion (thoracentesis, pleurodesis), brain mets (steroids, radiation).

Prognosis: NSCLC 5-year survival (stage I: 60-80%, stage IV: <5%); SCLC (limited: 20%, extensive: <5%).

References

UpToDate: “Lung Cancer: Diagnosis and Management” (2025). UpToDate Lung Cancer

NCCN: “Guidelines for Non-Small Cell Lung Cancer” (2024). NCCN NSCLC Guidelines

ASCO: “Management of Small Cell Lung Cancer” (2023). ASCO SCLC Guidelines

NEJM: “Immunotherapy in Advanced Lung Cancer” (2024). NEJM Immunotherapy

Case Scenarios

Case 1: A 68-Year-Old Male with Dyspnea and Facial Swelling

Presentation: A 68-year-old male with a 40-pack-year smoking history presents with dyspnea, facial swelling, and neck vein distension for 1 week. Exam shows T 37°C, BP 110/70 mmHg, SpO2 92% on room air, JVD, collateral veins on chest.

Labs/Imaging: CT chest shows a right hilar mass (SCLC confirmed by biopsy), SVC compression, no thrombus.

Diagnosis: SVC Syndrome (SCLC) → Facial swelling, JVD, hilar mass.

Management: Admit for SVC syndrome management. Elevate head of bed. Start dexamethasone 8 mg IV q6h to reduce edema. Urgent endovascular stenting of SVC (successful, symptoms improve). Start chemoradiation (carboplatin/etoposide + 20 Gy radiation). Monitor for tumor lysis syndrome (IV fluids, allopurinol 300 mg PO daily). Discharge with oncology follow-up.

Case 2: A 60-Year-Old Female with Worsening Dyspnea

Presentation: A 60-year-old female with stage IV NSCLC (EGFR mutation, on osimertinib) presents with 2 weeks of worsening dyspnea and right-sided chest pain. Exam shows T 37.5°C, RR 24/min, SpO2 90% on 2L O2, decreased breath sounds on right.

Labs/Imaging: Chest X-ray shows large right pleural effusion. Thoracentesis: Exudative, hemorrhagic fluid, cytology positive for adenocarcinoma.

Diagnosis: Malignant Pleural Effusion (NSCLC) → Dyspnea, effusion, stage IV NSCLC.

Management: Admit for effusion management. Therapeutic thoracentesis (1.2 L removed, dyspnea improves). Place indwelling pleural catheter for outpatient drainage (recurrent effusion expected). Continue osimertinib 80 mg PO daily. Supplemental oxygen for SpO2 <90%. Monitor for re-accumulation (daily weights, chest X-ray). Discharge with palliative care follow-up.

Case 3: A 55-Year-Old Male with Confusion and Lethargy

Presentation: A 55-year-old male with stage IV squamous cell NSCLC presents with confusion, lethargy, and polyuria for 3 days. Exam shows T 37°C, BP 100/60 mmHg, dry mucous membranes, altered mental status.

Labs/Imaging: Calcium 12.5 mg/dL, PTHrP elevated, CT head negative for metastases.

Diagnosis: Hypercalcemia of Malignancy (Squamous Cell NSCLC) → Confusion, hypercalcemia, PTHrP elevation.

Management: Admit for hypercalcemia management. Start IV fluids (NS 200 mL/h, monitor for overload). Zoledronic acid 4 mg IV over 15 minutes. Calcitonin 4 IU/kg IM q12h x 2 days (rapid effect). Monitor calcium daily (decreases to 9.5 mg/dL). Start chemotherapy (carboplatin + paclitaxel) to target tumor. Discharge with oncology follow-up.