Approach to Internal Medicine

A Resource Book for Clinical Practice

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Solitary Pulmonary Nodule

McWilliams et al. *NEJM* 2013;369(10)

DIFFERENTIAL DIAGNOSIS

MALIGNANT—bronchogenic, carcinoid, metastatic cancer

BENIGN—healed infectious granuloma, benign tumors (hamartoma), AVM, rheumatoid nodule, granulomatosis with polyangiitis (GPA), hydatid cyst, rounded atelectasis, intra-pulmonary lymph nodes, pseudotumor

PATHOPHYSIOLOGY

DEFINITION—≤3 cm well-defined lesion, completely surrounded by lung parenchyma

CLINICAL FEATURES

HISTORY—most patients are asymptomatic unless lesion is central; dyspnea, cough, hemoptysis, wheezing, chest pain, weight loss, fever, night sweats, rheumatologic screen, past travel history, occupational exposures, medical history (smoking, lung cancer or other malignancies, TB, infections, rheumatoid arthritis), medications

PHYSICAL—vitals, weight loss, clubbing, cyanosis, Horner syndrome, SVC syndrome, lymphadenopathy, respiratory examination, abdominal examination (hepatomegaly), bony tenderness

INVESTIGATIONS

BASIC

- **LABS**—CBC, lytes, urea, Cr, LDH, AST, ALT, ALP, bilirubin, INR, PTT
- **IMAGING**—old films (2 years earlier for comparison), CXR, CT chest

SPECIAL

- **ABG**
- **SCREENING FOR INFLAMMATORY DISORDERS**—ESR, CRP, ANA, ANCA
- **BIOPSY**—bronchoscopy or CT guided
- **PET/CT SCAN**—if moderate to high suspicion of lung cancer

DIAGNOSTIC ISSUES

FINDINGS SUGGESTIVE OF MALIGNANCY ★ABCD★

- **AGE** >50
- **BORDER**—irregular, nodular cavity with thick wall, or spiculated, corona radiata
- **CALCIFICATION**—eccentric or noncalcified
- **DIAMETER DEFINITION OF PULMONARY MASS >3 CM DIAMETER [>1.2 IN].** If <3 cm, 20–50% malignant. If ≥3 cm, 50% malignant

TIMING—if malignant, usually able to detect an increase in size of SPN between 30 days and 2 years. Unlikely to be malignant if significant change in <30 days or no change in 2 years

CALCIFICATION CLUES

- **MALIGNANCY**—eccentric calcification or noncalcified
- **TUBERCULOSIS** or **HISTOPLASMOSIS**—central/complete calcification
- **BENIGN HAMARTOMA**—classic appearance but only present <10% of the time

BROCK UNIVERSITY CANCER PREDICTION EQUATION

- **VARIABLES**—age, sex, family history of lung cancer, emphysema, nodule size, nodule type (nonsolid or ground-glass, partially solid, solid), upper lung involvement, nodule count, spiculation
- **OUTPUT**—probability of cancer within 2–4 years

MANAGEMENT

TREAT UNDERLYING CAUSE—if **low probability (<5%)**, observation with serial CT scans. If **moderate probability**, consider tissue sampling by bronchoscopy. If **high probability**, consider referral to pulmonary/interventional pulmonary medicine or thoracic surgery for staging and diagnosis

TREATMENT ISSUES

FLEISCHNER GUIDELINES FOR FOLLOWUP

SOLID PULMONARY NODULES

Nodule size	Low malignancy risk (<5%)	Moderate (5–65%) or high (>65%) malignancy risk
Solitary		
<6 mm	No routine follow-up	CT at 12 mo
6-8 mm	CT at 6-12 mo, then consider CT at 18–24 mo	CT at 6-12 mo, then CT at 18–24 mo
>8 mm	CT at 3 mo, then at 9 and 24 mo	PET/CT, biopsy or resection
Multiple (evaluation based on largest nodule)		
<6 mm	No routine follow-up	Optional CT at 12 mo
≥6 mm	CT at 3-6 mo, then consider CT at 18–24 mo	CT at 3–6 mo, then CT at 18–24 mo

NOTE—not applicable to patients <35 years, in lung cancer screening, with immunosuppression, known pulmonary disease, or symptoms of active primary cancer; CT chest performed without contrast as contiguous 1 mm sections using low dose; nodules unchanged >2 years are considered benign

SUB-SOLID PULMONARY NODULES

Nodule size	Recommendations
Solitary pure ground-glass	
<6 mm	No routine follow-up If high risk, consider CT at 2 and 4 y
≥6 mm	CT at 6–12 mo; if unchanged, CT q2 years until 5 y Growing nodules should undergo resection
Solitary part-solid	
<6 mm	No routine follow-up
≥6 mm	CT at 3–6 mo; if unchanged and solid component remains < 6 mm, annual CT chest for 5 y Nodules with solid component >8 mm or growing should undergo resection
Multiple	
<6 mm	CT at 3–6 months; if stable, no routine follow-up If high risk, consider CT at 2 and 4 y

TREATMENT ISSUES (CONT'D)

Nodule size	Recommendations
≥6 mm	CT at 3–6 mo; if stable, subsequent evaluation is based on most suspicious nodule

SPECIFIC ENTITIES

PANCOAST TUMOR

- PATHOPHYSIOLOGY—superior sulcus tumors (mostly squamous cell carcinoma) invading and compressing the paravertebral sympathetic chain and brachial plexus
- CLINICAL FEATURES—shoulder and arm pain (C8, T1, T2 distribution), **Horner syndrome** (upper lid ptosis, lower lid inverse ptosis, miosis, anhidrosis, enophthalmos, loss of ciliary-spinal reflex), and neurological symptoms in the arm (intrinsic muscles weakness and atrophy, pain and paresthesia of 4th and 5th digit). Other associated findings include clubbing, lymphadenopathy, phrenic or recurrent laryngeal nerve palsy, and superior vena cava syndrome
- DIAGNOSIS—CXR, CT chest, percutaneous core biopsy
- TREATMENTS—concurrent chemoradiotherapy

THORACIC OUTLET OBSTRUCTION

- PATHOPHYSIOLOGY—obstruction of the neurovascular bundle supplying the arm at the superior aperture of the thorax. Common structures affected include the brachial plexus (C8/T1 > C5/C6/C7, 95%), subclavian vein (4%), and subclavian artery (1%)
- CAUSES—**anatomic** (cervical ribs, congenital bands, subclavicular artery aneurysm), **repetitive hyperabduction/trauma** (hyperextension injury, painters, musicians), **neoplasm** (supraclavicular lymphadenopathy)
- CLINICAL FEATURES—triad of numbness, swelling and weakness of the affected upper limb, particularly when carrying heavy objects. Brittle finger nails, Raynaud phenomenon, thenar wasting and weakness, sensory loss, decreased radial and brachial pulses, pallor of limb with elevation, upper limb atrophy, drooping shoulders, supraclavicular and infraclavicular lymphadenopathy. Specific maneuvers include **Roos test** (repeatedly clench and unclench fists with arms abducted and externally rotated), **modified Adson maneuver** (Valsalva maneuver with the neck fully extended, affected arm elevated,

SPECIFIC ENTITIES (CONT'D)

and the chin turned away from the involved side), **costoclavicular maneuver** (shoulders thrust backward and downward), **hyperabduction maneuver** (raise hands above head with elbows flexed and extending out laterally from the body), and **Tinel maneuver** (light percussion of brachial plexus in supraclavicular fossa reproduces symptoms)

SPECIFIC ENTITIES (CONT'D)

- **DIAGNOSIS**—cervical spine films, CXR, MRI
- **TREATMENTS**—conservative (keep arms down at night, avoiding hyperabduction), surgery

Related Topics
Lung Cancer (p. 205)
SVC Syndrome (p. 244)