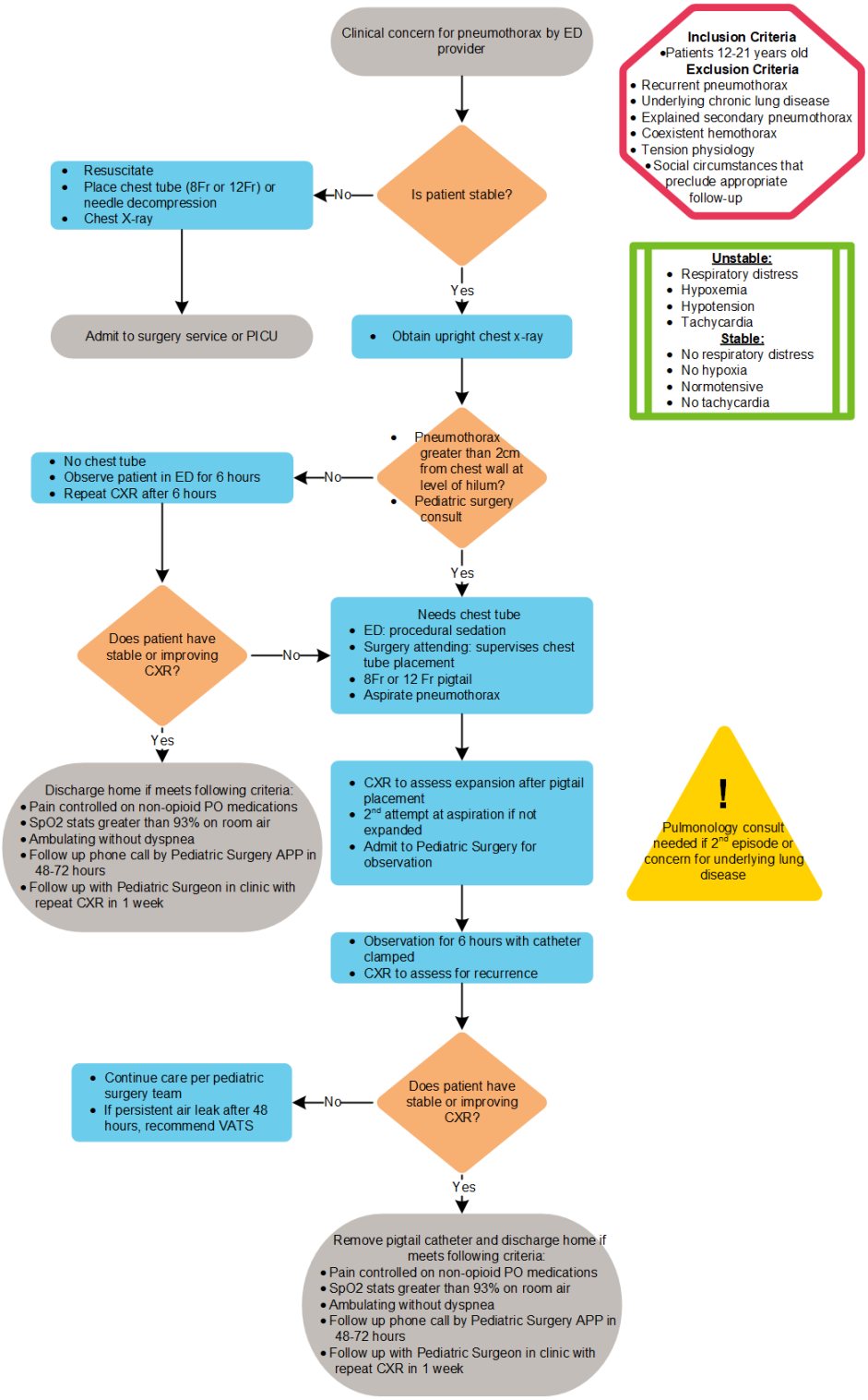
PEDIATRIC PRIMARY SPONTANEOUS PNEUMOTHORAX

SUSPECTED PNEUMOTHORAX DIAGNOSTIC ALGORITHM FOR EMERGENCY DEPARTMENT



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TARGET POPULATION

Inclusion Criteria: Patients with suspected or proven spontaneous pneumothorax

- Patients 12-21 years old

Exclusion Criteria: Patients with suspected or proven spontaneous pneumothorax

- Patients less than 12 years old
    - If patient is less than 12 years old, consult surgery on an individual basis
- Concern for recurrent pneumothorax, underlying chronic lung disease, explained secondary pneumothorax, coexistent hemothorax, tension physiology, social circumstances that preclude appropriate follow-up (as patients will require follow-up with PCP and Pediatric Surgery after diagnosis and treatment)

BACKGROUND | DEFINITIONS

This guideline is intended for patients ages 12-21 years old with first episode of primary spontaneous pneumothorax. If underlying lung disease is suspected, or if there is concern for second or recurrent episode of spontaneous pneumothorax, the pulmonary service should be consulted, and other treatment regimens should be considered. No procedure or surgical intervention may be required for select, hemodynamically stable patients with mild symptoms.

However, only those children with appropriate follow up can be managed with observation alone. Patients may require intervention with pigtail chest tube placement and/or operative intervention (VATS) for large or symptomatic pneumothoraxes. Recurrence rates of primary spontaneous pneumothorax remain high in the pediatric population.

INITIAL EVALUATION AND CLINICAL MANAGEMENT IN THE ANSCHUTZ ED

Triage Assessment

- Vital signs (VS)
- History regarding presentation
  - Document history of onset of chest pain or dyspnea
  - History of underlying lung disease
  - History of trauma
  - History of huffing, smoking, or breath holding
  - History of prior pneumothorax
- Clinical interventions
  - Keep patient upright and NPO
  - Apply oxygen if hypoxemic (SpO2 <93%)
  - Triage at least level 2
  - Place in room immediately for clinical evaluation

Monitoring

- VS per nursing protocol
- Cardiopulmonary monitoring
- Oxygen if patient is hypoxic (SpO2 <93%)

Fluids, Electrolytes, Nutrition

- NPO
- NS bolus if patient is unstable (decreased unilateral breath sounds, respiratory distress, hypotensive, tachycardic, hypoxic)

Initial Clinical Exam

Evaluate airway, breathing, circulation

- If the patient is **unstable** with clinical concern for pneumothorax, resuscitate as needed and proceed to treatment of unstable patients below
- If the patient is **stable**, proceed to imaging (CXR) – Upright PA
  - If pneumothorax is identified, measure the size on the x-ray
    - Small pneumothorax: less than or equal to 2 cm of air between chest wall and lung at the level of the hilum. Chest tube not indicated—treat with conservative management initially
    - Large pneumothorax: greater than or equal to 2 cm of air between chest wall and lung at the level of the hilum. Pigtail chest tube indicated for aspiration of pneumothorax
  - If concern for underlying lung disease or if this is patient's second (or recurrent) episode of spontaneous pneumothorax, recommend a pulmonary consult

Laboratory Studies

- No empiric labs required

Medications

- No empiric antibiotics required
- Pain management
  - PO analgesia with acetaminophen and NSAIDs +/- opioids for severe pain at ED discretion
  -

TREATMENT OF UNSTABLE PATIENT WITH PRIMARY SPONTANEOUS PNEUMOTHORAX

- Patients with respiratory distress, hypoxemia, hypotension, tachycardia
  - Administer 100% oxygen
  - 2 large bore IV catheters
  - NPO
  - IV fluid resuscitation
  - Obtain upright PA CXR
    - If pneumothorax confirmed and patient clinically unstable, needle decompression by ED team prior to proceeding down algorithm
    - If pneumothorax confirmed and patient stable, proceed with algorithm
  - Procedural sedation consent to be obtained by ED attending
  - Procedural consent to be completed by Pediatric Surgery team
  - Using local anesthesia, place 8fr or 12Fr pigtail chest tube for pneumothorax aspiration
  - Obtain upright PA CXR after pigtail placement or needle decompression
  - Admit to Pediatric Surgery service for further observation and monitoring. If patient is stable after pigtail chest tube or needle decompression, patient may be admitted to the inpatient unit for monitoring. If ongoing concerns for hemodynamic or clinical instability, patient may require admission to the PICU (Pediatric Surgery remains primary)
  - Note: tension pneumothorax is a clinical diagnosis and is not based on imaging findings alone

TREATMENT OF STABLE PATIENT WITH SMALL (LESS THAN 2CM) PRIMARY SPONTANEOUS PNEUMOTHORAX WITHOUT PIGTAIL CHEST TUBE

- Patients without respiratory distress, hypoxemia, hypotension, tachycardia
- Small pneumothorax (less than or equal to 2 cm of air between chest wall and lung at the level of the hilum) on CXR
- Consult Pediatric Surgery Service
- Observe patient in the ED for 6 hours after initial diagnosis of primary spontaneous pneumothorax on CXR. After 6 hours, repeat upright PA CXR. If CXR is stable or improving, the patient is hemodynamically stable, pain is controlled on non-opioid PO analgesia, patient is ambulating without dyspnea and able to keep SpO2 >93% on RA, can discharge home from the ED

- If failure of observation in the ED after 6 hours, admit to Pediatric Surgery service for ongoing observation on the inpatient unit. If worsening pneumothorax on repeat CXR, hemodynamic instability or worsening symptoms, proceed with pigtail placement (under the direction of the attending pediatric surgeon)
- Vital signs every 2 hours with pain score for the first 6 hours while being observed in the ED. If admitted, vital signs every 4 hours while on inpatient unit
- Continuous pulse ox and CR monitoring while in the ED or while on the inpatient unit if admitted
- The list below may be signs of deterioration:
    - Tachycardia
    - Hypotension
    - Increasing pain
    - Increasing dyspnea
- Use of 100% oxygen (nitrogen washout) is controversial and not clearly shown to decrease the pneumothorax
- Discharge criteria (from the ED or the inpatient units):
    - Stable or improving CXR, patient is hemodynamically stable, pain controlled on non-opioid PO analgesia, ambulating without dyspnea and able to keep SpO2 >93% on RA
    - Follow-up phone call with Pediatric Surgery APP 48-72 hours after discharge from ED or inpatient unit. Follow-up in Pediatric Surgery clinic with Pediatric Surgeon in 1 week with repeat CXR prior to follow-up appointment
    - Follow-up with PCP within 1 week of discharge from ED or inpatient unit

TREATMENT OF STABLE PATIENT WITH LARGE (GREATER THAN 2CM) PRIMARY SPONTANEOUS PNEUMOTHORAX WITH PIGTAIL CHEST TUBE

- Large pneumothorax (greater than or equal to 2 cm of air between chest wall and lung at the level of the hilum) on CXR
- Place on oxygen if unable to keep SpO2 >93% on RA and consult the pediatric surgery service
- Keep patient NPO
- ED attending:
    - Discuss the need for a pigtail chest tube with the pediatric surgery attending
    - Verbal consent for procedural sedation/anesthesia
    - Arrange and supervise the sedation following the 'Sedation Guidelines'
- Pediatric Surgery attending:
    - Consent for pigtail chest tube placement
- Supervise placement of 8Fr or 12Fr pigtail chest tube in ED for aspiration. The individual performing chest tube placement is per the discretion and supervision of the attending pediatric surgeon.
- After catheter placement, aspirate pneumothorax until air leak resolves
- CXR after pigtail placement to assess for lung re-expansion.
    - If incomplete lung re-expansion on repeat CXR, can perform second attempt at aspiration
    - If complete lung re-expansion on repeat CXR, clamp pigtail catheter
- After pigtail chest tube placement, admit to Pediatric Surgery (TACS) service. Observe on inpatient unit for 6 hours with catheter clamped. Follow-up CXR after 6 hours of catheter being clamped to assess for persistent or recurrent pneumothorax vs complete lung re-expansion

- If CXR stable or improved after pigtail catheter is clamped, patient remains stable on room air, hemodynamically stable, ambulating without dyspnea and pain is well controlled on non-opioid PO analgesia, remove pigtail catheter and discharge home
    - If CXR shows larger pneumothorax, place pigtail chest tube to suction; further management per pediatric surgical service
- If successful lung re-expansion within 48 hours, discharge home if meeting discharge criteria (mentioned below)
- If persistent air leak from pigtail chest tube, or only partial lung re-expansion on CXR at 48 hours, proceed with operative intervention (VATS)
- Discharge home from inpatient unit if: Stable or improving CXR, patient is hemodynamically stable, pain controlled on non-opioid PO analgesia, ambulating without dyspnea and able to keep SpO2 >93% on RA. Pigtail catheter will be removed by Pediatric Surgery team prior to discharge home

CONSIDERATION OF VIDEO-ASSISTED THORACOSCOPIC SURGERY (VATS)

- Failed pigtail aspiration trial at 6 hours (per Pediatric Surgeon discretion, could have discussions with family about early VATS vs admission to inpatient unit on Pediatric Surgery service for observation with VATS at 48-hour mark if no improvement)
- Recurrent episode of pneumothorax
- Presence of ongoing air leak from pigtail chest tube at 48 hours
- Partial lung re-expansion on CXR at 48 hours
- Presence of bullae/blebs on initial CXR
- Bilateral primary spontaneous pneumothorax
- Post-operative management after VATS
    - Chest tube management per pediatric surgeon
- Follow-up final surgical pathology report to determine need for post-operative imaging (ex. underlying lung disease identified on pathology report) and need for pulmonology consultation
    - Discharge home if meeting all medical criteria (listed below) with post-operative follow-up with operating surgeon in Pediatric Surgery clinic 2-3 weeks after hospital discharge
- Discharge criteria: Afebrile, stable or improving CXR (if obtained per Pediatric Surgeon discretion) after chest tube removal, patient is hemodynamically stable, tolerating regular diet, pain controlled on non-narcotic PO analgesia, ambulating without dyspnea and able to keep SpO2 >93% on RA

CONSIDERATION OF PULMONARY CONSULTATION

- Concern for underlying lung disease on admission or pre-operatively
- Second or recurrent episode of spontaneous pneumothorax
- Abnormality on final surgical pathology report
- For patients treated in Colorado Springs, consider outpatient referral to pulmonology at Anschutz

UTILITY OF COMPUTED TOMOGRAPHY (CT) SCANS IN PATIENTS WITH PRIMARY SPONTANEOUS PNEUMOTHORAX

- CT findings have not been shown to be predictive of recurrence rates and have significant false negative rates for air-containing lesions (blebs/bullae)
- No indication for routine use of CT with first episode of primary spontaneous pneumothorax
- No indication for routine use of CT to screen for contralateral blebs. CT findings have not been shown to be helpful in prophylactic management of contralateral findings.
- Consider CT if:
    - Bilateral disease
    - Suspected underlying pathology
    - Ipsilateral recurrence
    - New pneumothorax on contralateral side

DISCHARGE INSTRUCTIONS & PARENT/CAREGIVER EDUCATION

- There is still a high rate of pneumothorax reoccurrence in pediatric patients after conservative management, pigtail aspiration drainage, or VATS procedure. Close follow-up with both PCP and Pediatric Surgeon is recommended
- Air Travel and scuba diving are discouraged for 48 hours post-chest tube removal. Travel over mountain passes with caution due to low barometric pressure at high altitude
- If applicable, steri strips over thoracoscopic incisions will fall off on their own 7-14 days after surgery
- If applicable, occlusive dressing from previous pigtail or chest tube site can be removed 3-5 days after pigtail or chest tube removal if one was placed

Follow-up Instructions

- Pediatric Surgery APP to make follow-up phone call to patient/family 48-72 hours after ED/inpatient unit discharge
- Follow-up with Pediatric Surgeon in Pediatric Surgery clinic in 1 week after ED or inpatient unit discharge. Order CXR to be completed prior to clinic appointment with Pediatric Surgeon if treated with conservative management or pigtail aspiration
- Follow-up with operating surgeon in Pediatric Surgery clinic 2-3 weeks after hospital discharge if VATS performed during admission
- Follow-up with PCP within 1 week of ED or inpatient unit discharge
- Follow-up in pulmonary clinic if recurrent episode of pneumothorax, underlying lung disease is suspected, or if any abnormality is identified on surgical pathology report patients at urgent care or network of care sites with suspected or confirmed primary spontaneous pneumothorax

Triage Assessment

- See above, as initial triage assessment will be the same at Urgent Care/Network of Care Sites

Treatment in Unstable Patient with Suspected or Confirmed Primary Spontaneous Pneumothorax

- Follow algorithm above
- If patient can be stabilized after resuscitation for transfer to Anschutz Campus, call Anschutz Campus Surgeon on Call and ED team to transfer patient to Anschutz ED for management by Pediatric Surgery team

Treatment in Stable Patient with Suspected or Confirmed Primary Spontaneous Pneumothorax

- If patient meets criteria for observation as described above (stable with <2cm pneumothorax) can be observed in ED at NOC or Urgent Care facility if PEM attending is comfortable with this management
- Follow observation protocol above
- If pneumothorax is >2cm, transfer to Anschutz Medical Campus ED
- Transfer to Anschutz Medical Campus ED with any concerns

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