Co-management Guide

PEDIATRIC PULMONOLOGY	PULMONARY FUNCTION TESTING

Guidelines Referenced	
Background	Pulmonary Function Testing (PFT's) are a useful adjunct to defining types of lung disease, level of impairment and monitoring disease progression. PFT's are often part of the pulmonary evaluating in those patients who are able to perform the skill appropriates. The test performed depends on the disease entity and the question or symptoms are being addressed. Referral for PFT's do not require in-person consultation with a pediatric pulmonary provider yet results must be in interpreted in the context of the presentation with clinical correlation.
Initial Evaluation	History, physical exam, diagnostic evaluation as indicated for patients pulmonary symptoms/disease
Initial Management	As clinically indicated.
When to Refer	Refer to peds pulmonary when indicated. However, you may *consider* the following testing without peds pulm eval.
Pre-Visit Work Up	As clinically indicated. List of PFT's as follows; **SPIROMETRY** (CAN BE DONE AS PRE AND POST BRONCHODIALATOR) WHAT: Lung volumes and flows are measured during a forced exhalation maneuver. Includes a graphic record, total and timed vital capacity, expiratory flow rate measurement9s), with or without maximal voluntary ventilation. WHY: As a general rule held distinguish normal from abnormal and divide abnormal into two different patterns; obstructive and restrictive. HOW: Most common testing. Wearing a clip on your nose, you'll take a deep breath and exhale as hard as you can into the mouthpiece of the spirometer. It's important you seal your lips tightly around the spirometer's mouthpiece and rapidly exhale to the fullest extent until no further air can be exhaled. Usually, this maneuver will be performed at least three times to ensure consistent results. **LUNG VOLUMES BY PLETHYSMOGRAPHY** (CAN BE DONE AS PRE AND POST BRONCHODIALATOR) WHAT: Measurement of lung volumes such as total lung capacity, volume (the volume of air remaining in the lungs after the most forcible exhalation possible), functional residual capacity (volume of air present in the lungs at the end or a normal, passive exhalation) WHY: It is impossible to assess air trapping (increased residual volume relative to lung capacity HOW: you'll be seated in an enclosed, partially see-through or totally see-though box that resembles a phone booth. The technician will ask you to wear a nose clip and will instruct you how to breathe through a mouthpiece **DIFFUSION CAPACITY (DLCO)**

Measures how well carbon dioxide are diffused (transferred) between the lungs and the blood stream. Diffusing capacity is often low in certain lung diseases in which there is a disruption or reduction the lungs agiblity to allow CO2 to transfer across the alveolar capillary interphase such as pulmonary fibrosis or connective tissue disorder

IMPULSE OSCILLOMETRY

WHAT: Measures small airway resistance and conductance. Airways resistance most often are inversely proportional. (With increasing resistance there tends to be reduced conductance.

HOW: The patient is asked to perform normal tidal breathing into a mouthpiece connected to a "loudspeaker" that transmitted pulses and measure the "echo."

The pressure-flow oscillations are applied at the mouth superimposed on the subject's tidal breaths to measure respiratory system resistance and reactance.

FRACTIONAL EXHALED NITRIC OXIDE (FeNO)

WHAT: FeNO is a quantitative, noninvasive, simple, and safe method of measuring airway inflammation that provides a complementary tool to other ways of assessing airways disease in asthma patients.

Specifically, FeNO is an objective measurement of allergic/eosinophilic inflammation. Airway inflammation results from the activation of certain inflammatory cells result in the production of cytokines and release of NO

WHY: Nitric oxide is a byproduct of airway inflammtion and is increased at times of airway inflammation.

HOW: Measures the nitric oxide a patient exhales. High values (>35 in patients under 12 and >50 in patients 12 and up) supports a diagnosis of active asthma and the high likelihood that patients will response to antinflammatory therapy (corticosteroids.)

CARDIOLPULMONARY TESTING / VO2 MAX TESTING

WHAT: Cardiopulmonary exercise testing, including measurements of minute ventilation, CO2 production, O2 uptake, and electrocardiographic recordings

WHY: To assess clinical exhaustion, predicted maximum, heart rate [HRmax], oxygen uptake [$\dot{V}$ O2] plateau, maximal respiratory exchange ratio.

HOW: The first part of this test involves running on a treadmill as a computer monitors your carbon dioxide output. The results reveal:

1. How efficiently your body burns fat for energy
2. Your aerobic threshold, or the maximum level at which you're still working in your aerobic zone, not anaerobic zone. Aerobic threshold is an intensity you could run at for hours on end.
3. Your VO2 max, the maximum amount of oxygen you can utilize during intense or maximal exercise. VO2 max is generally considered the best indicator of an athlete's cardiovascular fitness and aerobic endurance.

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	METABOLIC TESTING WHAT: Helpful in calculating a patients daily caloric needs. WHY: This can be helpful in those patients who are overweight despite interventions directed at losing weigh or slowing down weight gain especially when the diet and exercise history would predicted better success. HOW: Test requires a fasting patients to simply breath normally in to a breathing apparatus for one hour. Data is reported as _____ computer analyzes your breath and heart rate to determine your RMR, the minimum number of calories your body needs to survive All testing is performed by one of two registered pediatric respiratory therapists and interpreted by one of two pediatric pulmonologsts. ALL of the above testing can be performed as part of pulmonary evaluation for those patients referred to pediatric pulmonology. ALL of the above testing can be ordered by any community provider and will be interpreted by a pediatric pulmonologist.	
Co-management Strategy (as appropriate)	Interpret PFT's	Discuss results with interpreting physician if/when necessary. Discuss results with patient and/or family as indicated.
Return to Primary Care Endpoint	PFT's without referral to peds pulm may require formal evaluation with peds pulm when clinical indicated in the context of the PFT's.	

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Order Set

(Please check all that apply)

☐Basic Spirometry (includes vital capacity)
☐Basic Spirometry with DLCO
☐Basic Spirometry with Maximum Inspiratory Pressure/Maximum Expiratory Pressure
☒Bronchodilator responsiveness (basic spirometry before and after bronchodilation)
☐Lung volumes obtained by plethysmography, airway resistance, airway conductance
☐Full Set (basic spirometry, plethysmography)
☐Nutrition Metabolic Study (Basal metabolic rate/resting energy expenditure)
☐Asthma Education (includes initial evaluation with pediatric pulmonologist)

Formal Cardiopulmonary Exercise Testing (includes pre-testing evaluation with pediatric pulmonologist)
☐Bronchospasm Provocation Testing (utilizing treadmill; pulmonary stress testing for brochnospasm with pre- and post-spirometry and oximetry)
☐Cardiopulmonary Stress Testing (utilizing treadmill; includes measurements of CO2 production, O2 uptake and electrocardiographic recordings)

All Pulmonary Function Testing is read and interpreted by Dr. Bruce Bacot, Pediatric Pulmonologist.

The PFT lab is staffed by licensed Respiratory Therapists with specialized credentials in pulmonary function testing and asthma education.