Seminar 4001 "Does Impulse Oscillometry Play a Role in Asthma Management"
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References
1. Google (impulse oscillometry Jaeger)
   select pdf article - (Forced oscillation technique and impulse oscillometry) by H. J. Smith, etal.
   This is a good article covering theory. I needed to huddle with an engineer to understand the equations. A physician can use the equipment without understanding the theory but it is helpful to know the theory especially the concept of reactance.
2. Shi, Y, etal, Relating small airways to asthma control by using impulse oscillometry in children, JACI 129, 3, 671-678
3. Larson, G, etal, Impulse oscillometry versus spirometry in a long term study of controller therapy for pediatric asthma. JACI 123, 4, 861-7

Notes
Resistance in Series
   Pressure = Flow x Resistance
   Total resistance = R1+R2…..

Resistance in Parallel
   Σ1/R = (1/R1+1/R2…..)

Natural Respiratory Oscillation
   Sine wave – resistance dependent on flow hence resistance is always changing

Impedance
   Impedance = effective pressure/effective flow after being discriminated from underlying respiratory pressure and flow and their harmonics.
   the total of properties which work against your effort to breath in elements downstream that cause a loss of energy

Location of obstruction
   Proximal airway obstruction increases resistance independent of oscillation frequency
   Distal airway obstruction is highest at low frequency of oscillation and falls with increasing frequency

Reactance
   Reactance = inertia of the gas moving through the conducting airways plus capacitance

Capacitance
   Low frequency capacitance expresses the ability of the respiratory tract to store energy primarily in the lung periphery. In both fibrosis and emphysema capacitance is reduced
   In fibrosis because of the stiffness of the lung
   In emphysema because of the hyperinflation and loss of lung elastic recoil.
   X5 increases in restriction and in hyperinflation-it does not differentiate

Resonant frequency
   Is defined as the frequency at which the magnitudes of capacitive and inertive reactance are equal

Static Compliance
   Static compliance = pulmonary compliance during periods without gas flow.

Dynamic Compliance
   Change in volume/change in pressure during the course of a breath
Impulse Oscillometry System
measures lungs during normal title breathing
sound wave creates the oscillations, breathing is normal. (Pleteysmography-diaphragm creates the energy).
Basic method: apply pressure to mouth and measure resulting change in flow
Resistance = pressure/flow
pressure in phase with flow
Reactance = echo pressure/flow
pressure out of phase with flow
what do we mean by "frequency"
frequency of breathing = 8 to 30 breaths per minute
frequency of impulses = 300 impulses per minute
each impulse has five sound frequencies
with each impulse:
  rapid changes in flow = 30Hz = 1800 cycles per minute
  slower changes in flow = 5-15 Hz = 300-900 cycles per minute
where do the impulses go
  all frequencies go to the larger airways
  only slow frequencies can get to the periphery
  (all - small) = large
Comparison of systems
Impulse oscillometry
  measures tidal breathing
  non effort dependent
  measures large and small airway resistance
  normalizes chest wall abnormalities
  determines the reactive component of the airway
  does not differentiate fibrosis from emphysema
  does not directly indicate air trapping
  expensive
  quick
  easy to maintain and train personnel
Spirometry
  measures maximal effort
  effort dependent
  does not measure small airways directly
  relatively quick
Pletysmography
  measures maximal effort
  effort dependent
  measures lung volumes and airway resistance
  requires training and skill in running the equipment
  expensive
  measurement takes time
All systems capable of adding information about:
  Reversibility
  Non-specific bronchial reactivity
  Specific bronchial reactivity