

Are the Eyes Better Than the Gas?

Use of a Five-Point Respiratory Exam

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Introduction

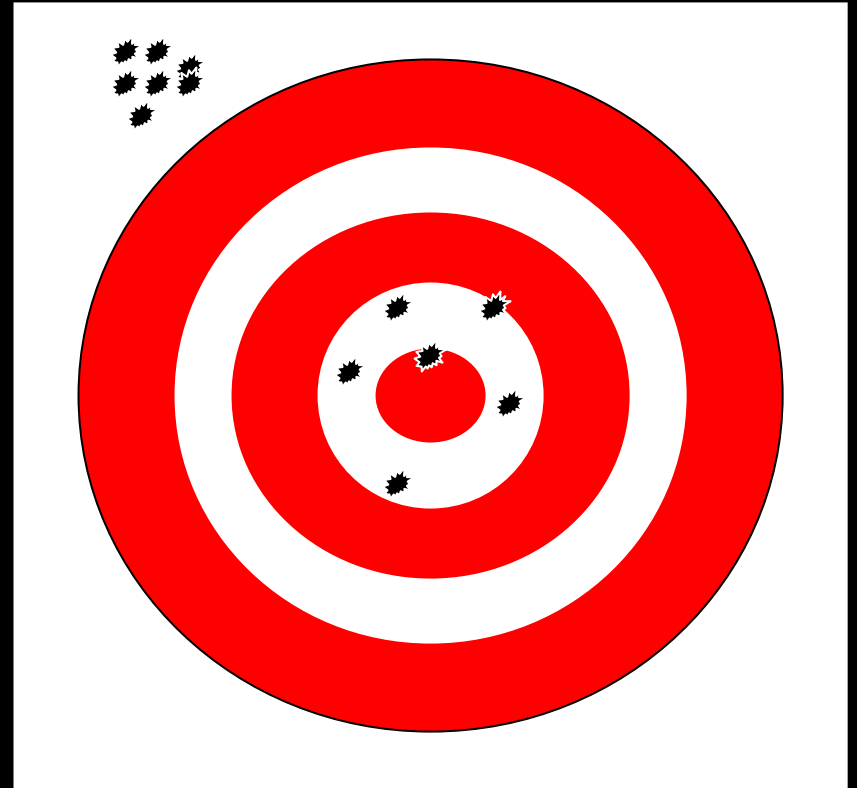
- Need for evaluation of respiratory function
 - ◆ To identify clinical deterioration
 - ◆ To identify response to therapy
 - ◆ To identify need for 911 emergency services
 - ◆ Reduce false positives (sending people to ED who do not need emergency services)
 - ◆ Reduce false negatives (missing subtle, covert respiratory dysfunction)

Introduction

- Eyes (clinical) v. Gas (laboratory)
 - ◆ Eye/clinical exam obtained in real time
 - ◆ Eye/clinical exam reveals patterns (pattern recognition used in expert decision making)
Science 1980; 208(20): 1335-1342
 - ◆ Gas/lab objective measurement
 - ◆ Gas/lab takes minutes, possibly hours, for results

Introduction

- Precision – hits the same place in a tight pattern
- Accuracy – keeps the pattern around the bull's eye



Introduction

- Need for rapid clinical evaluation tool for use in respiratory dysfunction

Background

- Asthma score

- ◆ PO₂ or cyanosis
- ◆ Inspiratory breath sounds
- ◆ Accessory muscles used
- ◆ Expiratory wheezing
- ◆ Cerebral function

A Clinical Scoring System for the Diagnosis of Respiratory Failure: Preliminary Report on Childhood Status Asthmaticus. DW Wood, et.al. Amer J Dis Child. 1972; 123:227-228.

Background

- Croup Score
 - ◆ Color
 - ◆ Air entry
 - ◆ Retractions
 - ◆ Level of consciousness
 - ◆ Stridor

Treatment of Laryngotracheobronchitis (Croup) LM
Taussig, et.al. Amer J Dis Child. 1975;129:790-793.

Background

- Five-Point Respiratory Exam

- ◆ Alertness
- ◆ Hypoxemia
- ◆ Respiratory Rate/Rhythm
- ◆ Work of Breathing
- ◆ Air Entry/Inspiratory:Expiratory Ratio

Perkin, van Stralen. My Child Can't Breathe: New Tools for the Recognition and Early Management of Pediatric Respiratory Failure. J Emerg Med Services. 1993;24(3):43-56.

Use of Exam

■ Alertness

- ◆ Does patient look at examiner, other staff member or family?
- ◆ Agitation, associated with dyspnea or sensation of suffocation
- ◆ Blunted or drowsy, associated with hypoxemia or hypercarbia
- ◆ Sensitive indicator of oxygenation and ventilation

Use of Exam

- Hypoxemia
 - ◆ Oxygen saturation is a ratio of saturated hemoglobin/total hemoglobin
 - ◆ Cyanosis is an absolute amount of deoxygenated hemoglobin (4 to 5 gm/dL Hgb)
 - ◆ Mucosa more closely represents arterial blood
 - ◆ Cyanosis is a late finding in anemia
 - ★ Patient with hemoglobin of 8 gm/dL will become cyanotic at about 50% oxygen saturation

Use of Exam

- Respiratory Rate and Rhythm
 - ◆ High respiratory rates may lead to breath stacking and inadvertent PEEP
 - ◆ Decreasing respiratory rates may represent respiratory muscle fatigue
 - ◆ Abnormal rhythm may represent underlying CNS lesion

Use of Exam

- Work of breathing
 - ◆ Increased heart rate
 - ◆ Diaphoresis
 - ◆ Accessory muscle use

Use of Exam

- Air Entry
 - ◆ Quiet breathing 5 mL/kg tidal volume
 - ◆ Chest expansion
 - ◆ Breath sounds reflect tidal volume; large tidal give louder sounds (Silence is not golden.)
 - ◆ Stridor – vibration of large airway
 - ◆ Wheeze – vibration of small airway

Use of Exam

- Inspiratory:Expiratory ratio
 - ◆ Prolonged inspiratory phase associated with upper airway obstruction
 - ◆ Prolonged expiratory phase associated with lower airway obstruction

Fine Tuning Exam

- Laminar flow
 - ◆ Resistance inversely proportional to fourth power of radius ($R \propto 1/r^4$)
 - ◆ Requires low velocity gas flow
- Turbulent flow
 - ◆ Resistance directly proportional to gas velocity
 - ◆ Occurs in larger diameter airways

Fine Tuning Exam

- Time Constant
 - ◆ $TC = \text{Resistance} \times \text{Compliance}$
 - ◆ 63% of lung empties or fills in one Time Constant
 - ◆ On expiration, long TC with high respiratory rate leads to breath stacking/
air trapping/inadvertant PEEP

Fine Tuning Management

- Assisted Ventilation
 - ◆ Enough tidal volume to expand chest
 - ◆ Slow enough rate to allow expiration

Interpretation

- Non-pulmonary causes of tachypnea
 - ◆ Generally high tidal volumes and high respiratory rates without airway obstruction
 - ◆ Example, Kuss Maul breathing in DKA

Interpretation

- Impending respiratory failure
 - ◆ Decreasing alertness
 - ◆ Decreasing work of breathing
 - ◆ *Decreasing air entry*

Interpretation

- Upper airway obstruction
 - ◆ Prolonged inspiratory phase
- Lower airway obstruction
 - ◆ Prolonged expiratory phase

Interpretation

- Response to therapy
 - ◆ Improvement – consider keeping at facility
 - ◆ Deterioration
 - ★ Consider alternative treatment
 - ★ Consider transfer to hospital
 - ◆ Early identification of non-responsive respiratory dysfunction can lead to safer transfer to hospital

Interpretation

- Red light
 - ◆ Impending respiratory failure
 - ◆ Failure to respond to therapy
- Green light
 - ◆ Patient responded to therapy

We are good at telling people when danger occurs, but we are less good at telling them when to stop treatment.