Update on Chronic Cough

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Disclosure

My name is Marc Haxer. During today’s course, I will be speaking on the topic of Chronic Cough. I work for Michigan Otolaryngology Surgery Associates and Eastern Michigan University and, other than a salary at both facilities, I have no relevant nonfinancial relationships to disclose.
Cough

- Occurs for a reason
  - Is an important defense mechanism that clears airway of foreign objects, secretions, and particulates
  - Transmits disease via expectoration of droplets and contamination of objects
  - Assists in maintaining consciousness during potentially fatal arrhythmias and/or converts arrhythmias to more normal cardiac movements
  - Is one of the most common complaints of individuals seeking medical care
Cough

- Additionally . . .
  - Cough relies on intact laryngeal sensation, laryngeal muscle control, and inspiratory/expiratory muscle strength/coordination
  - Despite this protective role, cough can result in multi-system issues
    - Anxiety
    - Compromise in quality of life
    - Dysphonia
    - Loss of consciousness, rib fractures, episodes of emesis
    - Incontinence
    - Insomnia

(Pitts and Sapienza, 2010; Sandage, 2009)
Cough Reflex Arc

- Initiated by sensory branch of cough reflex
  - Sensory nerve fibers distributed throughout ciliated epithelial cells of upper/lower airway from pharynx to terminal bronchioles
- Receptor triggered by chemical/mechanical stimuli
  - Foreign bodies, irritant particles, fumes, mass effect (tumor)
- Greatest concentration of cough receptors located in larynx, carina, and bifurcation of medium/large bronchi

(Simpson and Amin, 2006; Weldon, 2005)
Cough Reflex Arc

- Cough center of brain located in the medulla
  - Integrates impulses and coordinates complicated expiratory muscle activity that comprises and effective cough
- Efferent impulses leave medulla and travel to larynx and tracheobronchial tree via cranial nerve X and the intercostal muscles, abdominal wall, diaphragm, and pelvic floor via the phrenic and spinal motor nerves C3 through S2
Location of Cough Receptors

Region
- Paranasal
- Pharynx
- Larynx/tracheobronchial tree
- External auditory canal/tympanic membrane
- Esophagus, stomach, pleura
- Diaphragm/pericardium

(Simpson and Amin, 2006)

Afferent Nerve
- Trigeminal (V)
- Glossopharyngeal (IX)
- Vagus (X)
- Vagus (X)
- Phrenic
Phases of Cough Generation

- **Inspiratory**
  - Sudden deep gasp that fills lungs with air

- **Compressive**
  - Tight, valve-like closure of larynx
    - Glottic/supraglottic levels
    - Provides critical one-way valve effect that prevents egress of air

- **Contraction of expiratory muscles**
  - In face of closed glottis, creates dramatic increase in airway pressure
Phases of Cough Generation

- **Expiratory**
  - Laryngeal sphincter opens
  - Same results in explosive release of high-pressure air column
  - Contraction of expiratory muscles continues
  - VFs, supraglottic structures, and posterior commissure vibrate to actively displace secretions loosened from larynx
  - Cross-sectional area of trachea reduced significantly to allow for generation of powerful “tussive squeeze” which allows for clearance of secretions from tracheobronchial tree via high-velocity turbulent airflow
Cough – Differential Diagnosis
Cough – Differential Diagnosis

- Upper Respiratory Tract
- Allergic or vasomotor rhinitis, postnasal drip syndrome, infectious/post-infectious cough, sinusitis
  - Medical management
Cough – Differential Diagnosis

- Lower Respiratory Tract
  - Abscess, allergic inflammation, aspiration, asthma, bronchiectasis, bronchitis, COPD, cystic fibrosis, drugs, eosinophilic bronchitis, interstitial lung disease, pertussis, primary or metastatic lung tumors, sarcoidosis, tuberculosis
- Medical management
Cough – Differential Diagnosis

- Cardiovascular system
  - Left ventricular failure, mitral stenosis, medications (ACE inhibitors)
    - Medical management

- Gastrointestinal system
  - Reflux disease (GERD/LPRD)
    - Medical/behavioral management
Cough – Differential Diagnosis

- Central Nervous System (psychological response)
- Habit cough, chronic cough, psychogenic cough, neuropathic cough
  - Behavioral/medical management

(D’Urzo and Jugovic, 2002)
Causes of Cough
Causes of Cough

- Upper airway cough syndrome
  - Cough secondary to allergic/non-allergic rhinitis
- Asthma
  - Cough variant asthma
    - Diagnosis made after cough improves or resolves with anti-asthma therapy
- GERD – an elephant in the room?
  - Causes cough via irritation of CN X
    - Vagus nerve has fibers thought to be sensitive to acid/non-acid volume reflux
Causes of Cough

- LPRD – another elephant in the room?
  - Distinct entity from GERD
  - Regurgitation of stomach contents to level of larynx/pharynx
  - Resultant irritation of larynx/pharynx instead of esophagus as in GERD
    - Hypersensitivity/hyper-reactivity
Causes of Cough

- Medications
  - Angiotensin Converting Enzyme (ACE) Inhibitors
  - Chemotherapy
Causes of Cough

- Sensory Neuropathic Cough
  - Diagnosis of exclusion after myriad of examinations/evaluations completed
  - Suspect in patients with history of viral upper/lower respiratory infections, metabolic damage, mechanical trauma to CN X/SLN
  - Thought to be secondary to nerve degeneration/injury resulting in lowered threshold for sensory laryngeal nerve firing resulting in perceived throat irritation/chronic cough
    - in other words, nerve becomes hyper-sensitive
Causes of Cough

- Inclusion Criteria for Sensory Neuropathic Cough:
  - Intractable idiopathic long-standing cough
  - Tickle at sternal notch/other location in neck/throat presages episodes of cough
  - Some episodes described as severe
    - 10 seconds to 2 minutes, accompanied by oculo- and rhinorrhea, emesis, and occasionally laryngospasm, syncope, or near-syncope
  - Cough occurs spontaneously/associated w/triggers
    - Talking, laughing, exposure to temperature extremes, swallowing, etc.
  - Cough is nonproductive
    - If productive, always at end of severe attack (productivity a result of cough not a cause of cough

(Bastian, Vaidya, and Delsupehe, 2006)
Causes of Cough

- Exclusion Criteria for Sensory Neuropathic Cough
  - Emotional disconnect from problem
  - Identifiable secondary gain
  - Abrupt onset/offset of problem
  - Periods of complete resolution

(Bastian, Vaidya, and Delsupehe, 2006)
Chronic Cough
Chronic Cough

- Multiple names
  - Habit cough, behavioral cough, psychogenic cough
- > 8 weeks duration in adults; 4 weeks in children
- Excessive/unnecessary
- Productive versus nonproductive
- QOL deterioration
- Often secondary to multiple conditions
Chronic Cough

- Cough can co-exist with other laryngeal issues such as
  - Globus
  - Chronic throat clearing/cough
  - Dysphonia
  - PVFM/episodic laryngospasm
    - Above are symptoms of ILS
    - Continuum of laryngeal misbehavior
Evaluation/Treatment of Chronic Cough
Multi-disciplinary in Scope

- Pulmonary/Critical Care Medicine
- Allergy/Immunology
- Otolaryngology
- Gastroenterology
- Psychology/Psychiatry
- Pediatrics
- Speech Pathology

- Last one on list not because we’re not important
- Rather, all potential medical reasons for cough need to be ruled out before initiation of behavioral evaluation and management by us

- There is a growing body of evidence that supports speech pathologists taking a primary role in the management of cough, PVFM, and some reflux-related voice/airway disorders (Gaziano and Serrano, 2012; Vertigan and Gibson, 2016)
Pulmonary Disease

- Chest x-ray
  - Pulmonary changes, change in cardiac silhouette, adenopathy
- Spirometry
  - Flow-volume loop - determines presence of upper/lower airway restriction
- Pre-/post bronchodilator spirometry
  - Airway obstruction reversibility
- Methacholine challenge
  - Identifies airway hyper-responsiveness
  - Negative challenge rules out asthma
- Eosinophilic bronchitis
  - Cough responsive to use of cortico-steroids
  - Presenting symptoms can mimic silent reflux
- Bronchoscopy
  - Identifies anatomic abnormalities

(Sandage, 2009)
Pulmonary Disease

- **Treatment**
  - Inhaled corticosteroids w/wo spacer
  - Elimination of irritant(s)
  - Systemic corticosteroids
Upper Airway Cough Syndrome

- Allergy
  - Identify potential environmental triggers for cough
- Infections
  - Viral RIs, sinusitis, polyps
- Treatment
  - Buffered nasal rinses, nasal steroid spray
  - Use of first generation antihistamine decongestant therapy (Chlor-Trimeton)
  - Avoidance of offending allergens
Initial medical therapy should be intensive

- American College of Chest Physicians suggest empiric treatment with twice-daily PPI along with behavioral anti-reflux management for three months
- H2 receptor blockers @ HS as needed (Zantac no longer available)

Long-term maintenance will be necessary

Johnston, et.al. (2007); Birchall, et.al. (2008)
GERD/LPRD

- Behavioral treatment
  - Nothing to eat/drink within 3 hours of HS
  - If athlete, no solids 2 hours prior to practice/meets/ no liquids 1 hour prior to practice/meets
  - Upper body elevated during sleep and/or sleep on left side
  - Decrease intake of caffeine, acidic foods/beverages, spicy/fatty foods
  - Lose weight/wear loose-fitting clothing at waistline
Discontinuation of drug

With discontinuation, cough should improve or resolve within 4 weeks
Bastian, et.al.: 2006, 2009

Initial treatment
- Elavil 10mg @ HS for three days
- Titrate up by 10 mg every 3 days to maximum of 80 mg
- If patient cannot achieve 85% reduction in cough consider,

Gabapentin
- Build to 300 mg TID initially
- Can advance to as much as 2700 mg per day or more to desired benefit or tolerance

Other pharmacological interventions
- Lyrica
- Trileptal
- Botulinum Toxin Type A (Chu, Lieser, and Sinacort, 2010)

Adjunct behavioral management as per physician
Sensory Neuropathic Cough

- Medical Management
  - In patients with diagnosed motion impairment of the vocal folds (VF paresis) in addition to chronic cough, injection laryngoplasty resulted in reduction in cough in small cohort of patients (Crawley, Murry, and Sulica, 2015)
Behavioral Management
Behavioral Management

- Role of SLP
  - Medical history
  - Behavioral/environmental history
  - Endoscopy as needed
  - Behavioral education
  - Follow-up

(Sandage, 2009)
Behavioral Management

Evaluation

- Chart review
- Patient interview – remains the most valuable tool in the assessment/remediation of a laryngeal disorder
  - Nature (episodes short/long, mild/severe)
  - Pattern (time-specific, associated w/meals/certain activities, fluctuations)
  - Environment (new building materials, dry/dusty environment, worse w/exposure to heat/cold/odors/ventilation)
  - Stressors/emotional issues?
  - Patient awareness of cough onset
- RSI
- Leicester Cough Questionnaire/Cough Severity Index
- Use of probes to manage episodes of cough during evaluation

(Sandage, 2009; Stemple, et.al., 2010; Gibson and Vertigan, 2016)
Behavioral Management

- Therapy
  - Improve laryngeal environment
    - Increase hydration, nasal respiration
  - Train awareness of situations/sensations that precipitate cough
  - Implement strategies to allow for increased patient control of laryngeal function
    - Proactive (delay/eliminate cough onset)
    - Reactive (eliminate cough after emergence)
  - Assist in maximizing patient compliance with medical/pharmacological therapy

(Sandage, 2009; Gibson and Vertigan, 2009; Gibson and Vertigan, 2016)
Behavioral Management

Feature

- Cough occurs in bouts (Y/N)
- Cough occurs continuously (Y/N)
- Warning before cough (Y/N)
- No warning before cough (Y/N)

Potential treatment goals/strategies

- Implement strategies to suppress cough each time same is triggered
- Implement strategies to suppress cough for gradually increasing periods of time
- Implement strategies to suppress cough proactively
- Increase awareness of throat sensations; implement strategies even if warning sign(s) absent
**Feature**

- Deliberate coughing (Y/N)
- External locus of control (Y/N)
- Trigger(s) for cough identified

**Potential treatment goals/strategies**

- Breathing exercises for PVFM if relevant; education that cough is counter-productive
- Implement strategies to suppress cough in response to throat sensations
- Education re: rationale for behavioral treatment/mechanism behind voluntary control; encourage implementation of strategies
- Avoid exposure to trigger(s) for short period of time; gradual re-introduce exposure to trigger w/implementation of cough suppression strategies

(Vertigan, et.al, 2007; Vertigan and Gibson, 2016)
Behavioral Management

- Respiratory retraining
  - Manipulate configuration of VFs during symptomatic episodes
  - Control air pressure between VFs during symptomatic episodes
    - Increase resistance at level of glottis
Behavioral Management

- Respiratory retraining (Murry and Sapienza, 2010)
  - Quiet rhythmic breathing
    - Exhaling w/shoulders relaxed, abdominal movement in/out consistent w/ continuous exhalation/inhalation
  - Breathing w/vocal resistance
    - Exhaling while sustaining /sh/, /f/, /z/ for increasing lengths of time
  - Pulsed exhalation
    - Produce pulse of air using /ha/ or /sha/ followed by sniffing in through the nose w/closed mouth
  - Abdominal focus at rest
    - Lie flat w/small book on stomach, focus on elevation of book w/inhalation and lowering of book w/exhalation; when successful, straw breathing initiated to increase resistance while focusing on abdominal movement; exercise expanded to include sitting/standing
In addition to Murry and Sapienza, train patient in the following modified respiration strategies:

- In/out through nose
- In through nose, out against pursed lips
- In/out through pursed lips
- In through nose, out through straw
- In/out through straw
- Sniff in x2/out through pursed lips/straw
  - Vary length/bore of straw to increase/decrease resistance as needed by the patient
- Swallows (saliva, liquids, wet snacks, etc.)
Behavioral Management

- Respiratory retraining
- All exercises practiced in one-minute increments
  - Reduces patient boredom
  - Allows for repeated episodes of patient control over laryngeal function throughout the day
- Exercises #1-5 practiced 2x/day for 3 weeks
- Exercise #6 practiced 10/day for 3 weeks
  - 1st week in isolation (no distractions), always sitting down, using clock as timing device
  - Emphasize slow emptying of lungs during exhalation before repeating sequence to minimize risk of hyperventilation
  - Monitor # of repetitions achieved in one minute
Behavioral Management

- **Respiratory retraining**
  - **Week #2**
    - Pattern of sniff/blow transitioned into activities of daily living (not driving at this time)
    - Focus now on practicing X# of repetitions 10x/day
    - Maintain focus of complete exhalation before beginning new repetition
  - **Week #3**
    - As above but pattern can now be practiced while driving
  - **Week #4 and beyond**
    - Patient begins to experiment with all of the above techniques during episodes of cough
      - Determine which strategy(ies) are most efficacious in managing episodes of cough
    - Continue to maximize patient adherence to other interventions
    - Schedule therapy at 4, 6, 8, and 12 weeks initially
      - If progress demonstrated by 12 week mark, gradually schedule follow-up at greater intervals
      - If not, follow-up at 4 week intervals; recommend follow-up w/physicians as needed
In Summary...

- Effective management of cough involves multiple professionals/disciplines
  - Requires extensive testing to rule out medical bases for cough
  - Requires in-depth assessment and the development of specific intervention strategies by SLPs for cough management/cessation
  - Requires the development and maintenance of patient motivation throughout the course of treatment
    - Can be a “long and winding road” for some patients (clinicians too!)
  - Requires respect for patient QOL and their “comfort zone” with regard to practice and use of strategies regardless of the orientation of those interventions
  - Is a very rewarding experience when you and your patient arrive at the end-point of therapy and they can say to you:
    - “My cough is gone” or “I can live with my cough now that I have learned how to control it”
Thank you . . .


Bibliography


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Case Study #1

- 67 year-old female
- Six year history of dysphonia/cough and multiple environmental allergies
  - No salient event at time of cough onset
  - Cough occurs randomly throughout day/night
  - Also triggered by exposure to smells, fumes, and air movement
- Diagnosis of reflux
  - Same diagnosed during trans nasal esophagoscopy/esophagram
  - Self-score of 32 on RSI
  - Inconsistent adherence to behavioral reflux interventions
  - Preference for natural/holistic management
Case Study #1

- Therapy initiated
  - Swallows, modified respiration, behavioral anti-reflux management
  - Continued resistance to traditional recommended pharmacologic management of reflux
  - Inconsistent modification of diet along with herbal/holistic treatment
- Throughout Tx, repeat scorings of RSI revealed scores of 26, 12, and 32
  - As scores declined, cough declined
  - As scores increased, cough increased
  - Lowest score achieved w/use of Zantac bid
    - Patient declined to continue use of same beyond 2 weeks secondary to ongoing desire to use of herbal/holistic management
- Continued use of behavioral interventions with alleviation of cough
- Episodes of cough continued to occur
Case Study #1

- Most recent therapy session
  - Repeat scoring of 38 on RSI
  - Continued inconsistent diet modification
  - Patient admission that herbal/holistic management of reflux “not working”
  - Continued good management of cough w/use of behavioral strategies
  - However, continued episodes of cough
- Your thoughts/recommendations?
Case Study #2

- 59 year-old female
- Onset of cough/dysphonia 5-6 years previous
  - Seen by outside Otolaryngologist
  - Issues felt to be secondary to reflux given irritation of posterior larynx noted on exam
- Long history of recurrent bronchitis
  - 4-5 episodes per year
- Ongoing suspicion for reflux
  - Previous treatment w/PPIs
  - Cough decreased with PPI therapy
- History of C Diff
  - Use of PPIs stopped secondary to this
  - C Diff eliminated after completion of stool transplant
Case Study #2

- Patient complaints
  - Globus, dysphonia, cough, episodes of airway compromise focal to the throat

- Evaluation results
  - Consistent dysphonia
    - Not alleviated with use of vocal probes
  - Episode of cough alleviated w/use of strategies x1

- Your thoughts/recommendations?