

An Update on Speech Pathology Management of Chronic Refractory Cough



Anne E. Vertigan, PhD^{a,b,c}, Jemma Haines, BSc(Hons)^d, and Laurie Slovarp, PhD^e *New Lambton Heights, Callaghan, NSW, Australia; Manchester, UK; and Missoula, Mont*

Chronic cough is a common, debilitating condition that can persist for years with little relief from medical treatment. Speech pathology treatment is an effective treatment option for patients with chronic cough. This review outlines current speech pathology assessment and treatment for chronic cough and describes the evidence supporting the intervention. The rationale for speech pathology intervention is described with reference to speech pathology training and expertise that are relevant for this condition. Despite the efficacy and advantages of speech pathology intervention, there is limited guidance in the literature on when patients should be referred for treatment. Patients suitable for speech pathology intervention are those whose cough has persisted despite medical management. Speech pathology intervention may be particularly beneficial for patients with coexisting laryngeal disorders such as muscle tension dysphonia or inducible laryngeal obstruction. Limited information is available regarding current speech pathology training, practice, and service delivery for chronic cough internationally. Timely referral for speech pathology intervention could reduce the disease burden for individuals with chronic cough and decrease the economic burden of this complex condition. © 2019 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2019;7:1756-61)

Key words: *Chronic cough; Inducible laryngeal obstruction; Vocal cord dysfunction; Speech pathology*

Speech pathology treatment for chronic cough (SPTCC) was originally adapted from voice therapy techniques used to treat hyperfunctional voice disorders.¹ The aims of SPTCC are to

improve voluntary control of the urge to cough and reduce laryngeal irritation that triggers coughing episodes. The efficacy of SPTCC has been evaluated in chronic refractory cough (CRC); however, there is currently no evidence-based systematic approach about the timing of SPTCC in relation to other medical treatment. Regardless, minimum medical management should always precede consideration of SPTCC.

MEDICAL MANAGEMENT OF COUGH

Most published guidelines recommend a protocol-based assessment that includes ruling out of alarm symptoms and findings that suggest a potential serious underlying disease² (eg, hemoptysis, history of heavy smoking, prominent dyspnea at rest, significant productive cough, hoarseness, recurrent pneumonia, abnormal chest radiograph), followed by consideration and targeting of the most common and remedial causes of chronic cough (ie, angiotensin-converting enzyme inhibitor use, asthma, rhinosinusitis, eosinophilic bronchitis, gastroesophageal reflux disease, and obstructive sleep apnea).² If these considerations have been addressed without a therapeutic response or diagnosis of underlying disease, a diagnosis of CRC can be made,^{2,3} at which point a referral for SPTCC may be appropriate.

SPEECH PATHOLOGY ASSESSMENT FOR COUGH CONTROL THERAPY

The first stage of speech pathology management of CRC is to conduct an assessment to measure symptoms, understand laryngeal physiology, and determine if an individual is a good candidate for SPTCC. Case history (Table 1) and patient-reported symptom rating scales such as the Leicester Cough Questionnaire⁴ or Laryngeal Hypersensitivity Questionnaire⁵ are key assessment components. Additional questionnaires pertaining to commonly co-occurring disorders, such as vocal cord dysfunction (VCD; a form of inducible laryngeal obstruction [ILO], which is the taxonomy recommended in a recent international consensus statement by the European Respiratory Society, European Laryngological Society, and the American College of Chest Physicians⁶ and muscle tension dysphonia (MTD), may also be helpful such as the Vocal Cord Dysfunction Questionnaire,⁷ Pittsburgh Vocal Cord Dysfunction Index,⁸ and Voice Handicap Index.⁹ Questionnaires are inexpensive, efficient, and noninvasive and provide measures of symptoms that establish severity and measure change over time. Observations of breathing and cough patterns during quiet respiration, physical activity, speech, and swallowing help to identify patterns that may be responsive to behavioral therapy. Assessment of voice is an important component of assessment as patients frequently report talking as a trigger for coughing and hyperfunctional

^aSpeech Pathology Department, John Hunter Hospital, New Lambton Heights, NSW, Australia

^bSchool of Medicine and Public Health, University of Newcastle, Callaghan, NSW, Australia

^cPriority Research Centre for Healthy Lungs, Hunter Medical Research Institute, New Lambton Heights, NSW, Australia

^dNorth West Lung Centre, Manchester University NHS Foundation Trust Wythenshawe Hospital, Manchester, United Kingdom

^eSpeech, Language, Hearing Sciences Department, University of Montana, Missoula, Mont

No funding was received for this work.

Conflicts of interest: The authors declare that they have no relevant conflicts of interest.

Received for publication December 17, 2018; revised manuscript received and accepted for publication March 20, 2019.

Available online March 30, 2019.

Corresponding author: Anne E. Vertigan, PhD, John Hunter Hospital, Locked Bag 1, Hunter Region Mail Centre, NSW 2310, Australia. E-mail: anne.vertigan@health.nsw.gov.au.

2213-2198

© 2019 American Academy of Allergy, Asthma & Immunology

<https://doi.org/10.1016/j.jaip.2019.03.030>

Abbreviations used

CRC- Chronic refractory cough

ILO- Inducible laryngeal obstruction

MTD- Muscle tension dysphonia

SPTCC- Speech pathology treatment for chronic cough

VCD- Vocal cord dysfunction

phonation patterns may contribute to laryngeal hyperresponsiveness, which may contribute to cough.

Functional transnasal laryngoscopy provides a comprehensive evaluation of laryngeal function and objective assessment of laryngeal physiology during respiration and phonation. It facilitates early identification of hyperfunctional muscle patterns that commonly co-occur in patients with CRC and determines whether mucous hypersecretion is present. In our experience, many patients complain of a sensation of mucous in the laryngeal region in the absence of excess mucous observed during laryngoscopy. Such a scenario suggests the presence of hypersensitivity or hyperawareness of normally occurring secretions. Odor and exercise challenge can also be incorporated during laryngoscopy to examine the patient's response to suspected triggering stimuli.¹⁰ The presence or absence of cough, number of coughs, severity of cough, urge to cough,¹¹ presence of paradoxical vocal fold movement, and change in vocal quality can all be documented. These data can serve as a baseline measurement from which to compare later on in therapy. Access to laryngoscopy for patients with CRC can be variable and will depend on the availability of equipment, trained staff, institutional policies, and fee/payment systems.

SPEECH PATHOLOGY TREATMENT

SPTCC involves 4 components: education, cough suppression strategies, reducing laryngeal irritation, and psychoeducational counseling.¹² Treatment is provided by a qualified speech pathologist usually over 3 to 4 sessions.

Education

The purpose of education is to assist patients to understand the goals and rationale for therapy and to facilitate patient engagement in the therapy process. The education component of treatment involves explanation of cough mechanisms and abnormal laryngeal movement. Of particular importance is the role of cough hypersensitivity whereby the cough is sensitized to be triggered by either nontussive stimuli or low levels of tussive stimuli, in the absence of a physiological need to cough. In other words, although the urge to cough is real, there is no physiological benefit to cough and there are negative side effects to repeated coughing. This physiological explanation makes sense to many patients and assists them to understand the rationale for therapy. It is helpful to reassure the patient that in up to 20% of patients the cause for the cough cannot be found despite thorough medical investigation and that the larynx can be the source of cough and respiratory symptoms.^{3,13} It is beneficial to reinforce the capacity for the brain to develop voluntary control of cough as many patients believe the cough occurs outside of their control. Furthermore, studies¹⁴ have shown a reduction in cough sensitivity and urge to cough after SPTCC, which suggests that the therapy fosters a mechanistic change. Fostering patient

understanding that therapy is not simply about improving their ability to control cough, but also aims to reduce the hypersensitivity is often beneficial for patient motivation.

Cough suppression strategies

Cough suppression strategies include breathing and laryngeal reposturing techniques that release laryngeal constriction and promote efficient airflow during respiration and phonation. The aim is to prevent or interrupt cough episodes. Patients are taught to identify the sensation precipitating cough and to substitute cough with alternative and less phonotraumatic behavior. Symptom control exercises are taught in a hierarchy beginning with the clinical setting, to asymptomatic periods outside the clinical setting, to using the techniques during symptomatic periods, and finally during deliberate exposure to triggers.

Reducing laryngeal irritation

The third component of treatment is reducing laryngeal irritation. This is achieved by reducing exposure to laryngeal irritants such as alcohol, reflux, or oral breathing, improving hydration, and reducing phonotraumatic vocal behaviors that exacerbate laryngeal irritation and trigger coughing. Desensitization, involving deliberate exposure with coaching through cough suppression strategies, may also be helpful for some patients with cough triggered by specific irritants.

Psychoeducational counseling

Psychoeducational counseling addresses motivation, adherence to therapy, and facilitates appropriate beliefs about the condition and the role of behavioral therapy. It is important for patients to understand that behavioral control of cough requires commitment. The patient is supported to develop realistic goals during therapy. Acknowledging emotional issues as a trigger is also helpful.

EVIDENCE FOR SPEECH PATHOLOGY TREATMENT

Speech pathology treatment results in improved quality of life, reduced cough reflex sensitivity, reduced urge to cough, and reduced cough frequency.¹⁵ Early studies of speech pathology intervention consisted of small case series.^{1,16-18} Although these studies were preliminary with small patient numbers and no control groups, they provided initial evidence to support the treatment. Two subsequent randomized control trials of speech pathology treatment for cough have been reported in the literature. In the first study,¹⁹ 87 patients with chronic cough that was refractory to medical management were randomly assigned to receive either 4 sessions of speech pathology treatment for chronic cough or an equivalent course of healthy lifestyle education. Eighty-eight percent of participants in the treatment group had a positive outcome compared with 14% in the placebo group. There was also a greater improvement in symptom frequency and severity scores for breathing, cough, voice, and upper airway symptoms in the treatment group than the placebo group. In a similar study, using the same treatment methodology, Chamberlain et al²⁰ conducted a multicenter randomized control trial. The therapy was provided by either a trained physiotherapist or speech-language pathologist. Participants received 4 weekly sessions of either SPTCC or healthy lifestyle advice. Results showed greater improvement in Leicester Cough Questionnaire scores and a reduction in cough frequency in the treatment group than the control group.

TABLE I. Common case history questions asked during speech pathology assessment for chronic cough

Onset/progression	When did symptoms begin? Did the cough begin with a cough-inducing illness? Symptom progression? <i>Stable/progressing/improving</i>	
Cough symptoms	TRIGGERS: Smoke? Fumes/bleach/aerosols? Automobile exhaust? Perfume? Exercise? Humidity? SENSATIONS: Do you feel the cough coming? What does it feel like? <i>Tickle/itch/pain</i> Are you able to suppress the cough? If so, how? How often? How long? Where does it feel like the cough comes from? <i>Throat/chest/both/unsure</i> COUGH PATTERNS: What does the cough sound like? <i>Normal/moist/dry/honking</i> Is the cough productive? If so, how often? How much? Single cough, several coughs, or long bouts of coughing? Does the cough lead to gagging or vomiting? If so, how often?	Talking/laughing/telephone? Cold air/air conditioning? Shortness of breath? Stress/anxiety? Sensation in throat? Eating? (If so, what type of food?)
Breathing symptoms	More difficult to breath in, out, or both? Triggers? (same as under cough symptoms) Throat tightness? Chest tightness? Stridor?	Immediate or gradual onset? Immediate or gradual resolution? Does a bronchodilator help? If so, how quickly? Numbness? If so, where? Dizziness?
Voice symptoms	Dysphonia? Pattern of dysphonia: consistent? Comes and goes? Predictable? Unpredictable?	
Vocal hygiene	Vocal abuse habits? Smoking? Hydration? Caffeine? Alcohol?	Drugs? Exposure to fumes? Mold? Professional voice user? Breathing route? <i>Mouth/nose/both/unsure</i>
Medical history	REFLUX: Symptoms? Previous treatment? Treatment effect for reflux symptoms? Cough? ASTHMA: How was it diagnosed? Previous treatment(s)? Treatment effect for asthma symptoms? Cough? GENERAL: ACE inhibitor? ENT evaluation and results? Pulmonary evaluation and results?	RHINITIS: Previous treatment? Treatment effect for rhinitis? Cough? Allergy evaluation and results? Adherence to medical recommendations? Obstructive sleep apnea?
Social history	Loss of work? Avoidance of social situations? Incontinence?	

ACE, Angiotensin converting enzyme; ENT, ear, nose, and throat.

MECHANISMS FOR IMPROVEMENT IN COUGH

The mechanisms behind improvement in cough after speech pathology intervention are not yet fully understood. Cough reflex sensitivity improves after speech pathology treatment of cough,¹⁴ but the mechanism responsible for a change in sensitivity is unknown. It is also possible that speech pathology treatment improves cortical control over cough. Functional magnetic resonance imaging studies have shown that the cough suppression network is impaired in patients

with chronic cough²¹ and that placebo antitussive administration leads to reduced activity associated with capsaicin inhalation in the somatosensory, primary motor, insula, and cingulate cortices, and increased activation in the prefrontal and left parietal cortices.²² The treatment effect may also be affected by reduced laryngeal irritation, reprogramming maladaptive responses, and treatment of coexisting dysphonia and ILO. The components and outcomes of SPTCC are summarized in [Figure 1](#).

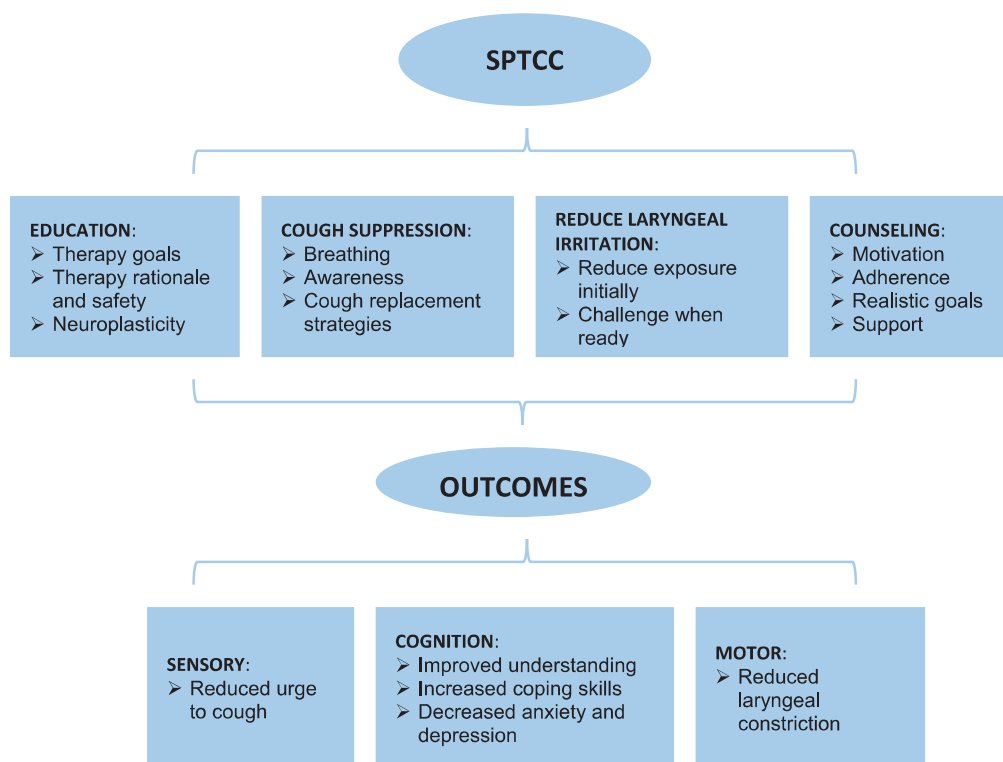


FIGURE 1. Schematic diagram of the components and outcomes of speech pathology treatment for chronic cough (SPTCC).

WHAT PATIENTS ARE GOOD CANDIDATES FOR SPEECH PATHOLOGY TREATMENT OF CHRONIC COUGH?

According to the 2016 CHEST guidelines, once a diagnosis of CRC is made, physicians are encouraged to consider SPTCC, empiric neuromodulator trial, referral to a specialty cough clinic, or recruitment to a clinical trial.³ Although there is currently no evidence-based systematic approach that indicates SPTCC over the other options, consideration of patient symptoms, comorbidities, and patient input is helpful in determining if SPTCC is the most appropriate next step.

There are several symptoms patients successfully treated with SPTCC commonly report, although not every patient will have every symptom. The most consistent symptoms include nonproductive cough, abnormal laryngeal sensations such as a tickle or itch in throat, tight throat, throat dryness, globus (laryngeal paresthesia),²³ cough triggered by nontussive stimuli (allotusia) such as cold air, perfumes, talking, laughing, exertion, dry crumbly foods, and/or cough triggered by low doses of tussive stimuli (hypertussia) such as chemical fumes and smoke.²³ In addition, Slovarp et al²⁴ found that patients successfully treated with SPTCC more frequently described their personality as anxious, stressed, and worrisome than patients successfully treated with medical intervention.

Up to 85% of patients with CRC also suffer from symptoms similar to MTD and/or VCD²⁵ both of which are typically treated by the same therapists who provide SPTCC.^{24,26,27} This evidence suggests that VCD and MTD may need to be considered as coexisting disorders in patients presenting with CRC. Patients who present with symptoms suggestive of either of these conditions are, therefore, ideal candidates for SPTCC.

MTD is a hyperfunctional voice disorder characterized by excessive tension in the laryngeal musculature during phonation. The tension contributes to symptoms such as a strained or harsh vocal quality, variable pitch or voice breaks, intermittent falsetto voice, vocal fatigue, and reports of neck, tongue, or jaw tension.²⁸⁻³⁰ Auditory-perceptual deviations of voice quality such as breathy, rough, strained qualities, pitch, and phonation breaks are frequently present during sustained phonation and connected speech. Laryngeal palpation often reveals suprahyoid tension, elevated larynx, reduced hyolaryngeal space, and complaints of tenderness in the muscles in and surrounding the larynx that are common among patients with MTD.^{28,29,31}

VCD describes inappropriate laryngeal closure during respiration, with airflow obstruction occurring at the glottic and/or supraglottic level, leading to breathing problems.³² Laryngeal dysfunction³³ suggests laryngeal hypersensitivity with resultant sensory hyperresponsiveness that can lead to the exaggerated reaction of the larynx, manifesting in several overlapping ways as cough, paradoxical vocal fold movement, or dysphonia. This may explain why VCD is common in patients with CRC with or without MTD.

Lastly, patient input should be considered when determining whether a patient is a good candidate for SPTCC. Patients must first receive basic education about SPTCC to make an informed decision. A brief explanation about what SPTCC entails and that it is an evidence-based, noninvasive treatment, with a high success rate in patients with CRC, helps patients make an informed decision. The likelihood of therapy adherence should also be considered. Patients who are looking for a quick fix, are not easily able to attend therapy sessions, or are unlikely to follow through with recommendations outside of therapy are not good candidates for SPTCC.

TREATMENT CONSIDERATIONS

Speech pathology treatment for chronic cough is increasingly recognized as effective^{19,20} in the management of CRC and can improve cough sensitivity and cough-related quality of life.³⁴ Despite this, little is known or understood regarding optimal delivery of care. The timing, duration, frequency, mode of delivery, who delivers, outcomes, and what are the effective components of SPTCC have yet to be systematically investigated. Furthermore, characterization of patients who do not respond to SPTCC is not known. Therefore, clear guidance on patient selection criteria for SPTCC is not well defined. Currently, there is no evidence to support SPTCC before medical intervention,³⁵ but the timing of SPTCC intervention should be carefully considered. Despite established efficacy, SPTCC is rarely considered early in treatment algorithms.

SPTCC has several advantages. It may be cost effective, as it does not require expensive medication or equipment, although cost-effectiveness has not been formally established. It has minimal side effects and does not have negative side effects from combining with other treatments. It is noninvasive and typically treatment effects are notable after 2 to 4 sessions of therapy. SPTCC empowers patients to take active control over their symptoms. However, in all studies reporting the benefits of SPTCC, none report the complete resolution of symptoms in all patients. There is some evidence that combining SPTCC with centrally acting neuromodulators may enhance the treatment effect.³⁶

Service delivery

As earlier described, key component themes are commonly reported in SPTCC (education, cough suppression, laryngeal hygiene, psychoeducational counseling). It is yet known which of these components are the most effective, if any, or whether a combination approach is of greater value.

A systematic review of SPTCC in CRC³⁴ identified a package of treatment over 3 or 4 sessions (weekly, over 2 months, or within 16 weeks) that appears to decrease cough reflex sensitivity and improve cough-related quality of life. However, more in-depth studies comparing treatment durations and frequency are needed to facilitate understanding on the most effective care delivery model.

Although speech pathologists are the most common professionals providing nonpharmacologic cough intervention, physiotherapists are also reported to provide similar treatment in certain parts of the world.^{20,37} Given speech pathologists' expertise in assessment, diagnosis, and management of laryngeal dysfunction, and the significant crossover in CRC symptoms with other laryngeal disorders routinely treated by speech pathologists (eg, MTD and VCD),¹⁵ speech pathologists are well suited to provide this therapy and characteristically manage the spectrum of disorders holistically.³⁸ Conversely, physiotherapists have specialized skills in chest clearance, muscular skeletal management, and pulmonary rehabilitation, which also may have its advantages. It is not known whether the outcome of treatment alters, or is dependent on, the clinician's professional background and this warrants further investigation.

Competencies

Management of patients with CRC is an expanding area for speech pathology practice, but, based on experiential knowledge, clinical exposure to treatment is variable.³⁹ Training of speech

pathologists in the management of CRC has become more available over recent years and is included in many university programs; however, the extent of expertise varies between regions and countries. Typically speech pathologists who work with voice disorders are able to manage patients with cough.

There are many unknowns regarding current clinical practice with CRC and no competency frameworks currently exist to support clinicians routinely working with this client group. Workforce development strategies need to include capability guidelines/frameworks to ensure that patients with CRC receive effective care from appropriately trained clinicians. Further research is needed to fully understand current service delivery for SPTCC internationally. Establishing a better understanding on "standard care," would enable better comparisons in future research studies on nonpharmacologic interventions for CRC.

Many speech pathology skills are transferable from one area of current clinical practice to another. However, at a very minimum, it is recommended that speech pathologists managing CRC have undergraduate/postgraduate training in laryngeal mechanisms and experience in disorders commonly associated with it. Furthermore, given the diversity of etiologies associated with the CRC population, it is essential that all speech pathologists work in close contact with multidisciplinary team colleagues.

Terminology

Terminology around SPTCC is important to consider. A range of terms have been used in clinical and research settings including *behavioral cough therapy* or *behavioral cough suppression therapy*.⁴⁰ Some people do not like the word *behavioral*; however, the term makes it clear that it is not a pharmacologic treatment. Some may also favor the lack of "speech" in the name, because the treatment does not directly target speech articulation. The term *cough control therapy* has also been proposed, although can create confusion as the acronym CCT is also used for cough challenge testing (CCT). The term *cough control therapy* may also suggest that we are just teaching patients to have better control over their cough when the evidence suggests that the therapy also stimulates a neuroplastic change in cough sensitivity. Ideally 1 universal term that is agreed on and consistently used would improve the interprofessional understanding of the therapy.

FUTURE DIRECTIONS

There are a number of research priorities to further understand speech pathology management of chronic cough. Further research is needed to understand the mechanisms responsible for improvement after SPTCC, particularly those that explain the reduction in cough sensitivity. The specific components of the therapy program that are responsible for improvement also warrant further study, as well as the most ideal delivery model including the most appropriate time to consider SPTCC with consideration of safety, cost-effectiveness, and efficiency of care. Patients with cough secondary to lung disease such as lung cancer or interstitial lung disease may benefit from SPTCC for symptom control, although further research would be needed to establish efficacy.

CONCLUSIONS

The efficacy of speech pathology treatment for CRC is well established. If provided as a routine treatment option for appropriate patients, there could be a significant positive impact

not only for individual sufferers but also for reducing the economic burden of this complex condition. Addressing key research priorities will further improve care for those with CRC.

REFERENCES

- Blager F, Gay M, Wood R. Voice therapy techniques adapted to treatment of habit cough: pilot study. *J Commun Disord* 1988;21:393-400.
- Gibson PG, Chang AB, Glasgow NJ, Holmes PW, Katelaris P, Kemp AS, et al. CICADA: cough in children and adults: diagnosis and assessment. Australian cough guidelines summary statement. *Med J Aust* 2010;192:265-71.
- Gibson P, Wang G, McGarvey L, Vertigan AE, Altman KW, Birring SS. Treatment of unexplained chronic cough: CHEST guideline and Expert Panel Report. *Chest* 2016;149:27-44.
- Birring S, Prudon B, Carr A, Singh S, Morgan M, Pavord I. Development of a symptom specific health status measure for patients with chronic cough: Leicester Cough Questionnaire. *Thorax* 2003;58:339-43.
- Vertigan AE, Bone SL, Gibson PG. Development and validation of the Newcastle laryngeal hypersensitivity questionnaire. *Cough* 2014;10:1.
- Christensen PM, Heimdal JH, Christopher KL, Bucca C, Cantarella G, Friedrich G, et al. ERS/ELSA/ACCP 2013 international consensus conference nomenclature on inducible laryngeal obstructions. *Eur Respir Rev* 2015;24:445-50.
- Fowler SJ, Thurston A, Chesworth B, Cheng V, Constantinou P, Vyas A, et al. The VCDQ—a questionnaire for symptom monitoring in vocal cord dysfunction. *Clin Exp Allergy* 2015;45:1406-11.
- Traister RS, Fajt ML, Landsittel D, Petrov AA. A novel scoring system to distinguish vocal cord dysfunction from asthma. *J Allergy Clin Immunol Pract* 2014;2:65-9.
- Jacobson H, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger M. The voice handicap index (VHI): development and validation. *Am J Speech Lang Pathol* 1997;6:66-70.
- Forrest L, Husein T, Husein O. Paradoxical vocal cord motion: classification and treatment. *Laryngoscope* 2012;122:844-53.
- Davenport P, Sapienza C, Bolser D. Psychophysical assessment of the urge to cough. *Eur Respir J* 2002;12:249-53.
- Nacci A, Fattori B, Segnini G, Dallan I, Panicucci E, Rocchi V, et al. Respiratory retraining therapy in long-term treatment of paradoxical vocal fold dysfunction. *Folia Phoniatr Logop* 2011;63:134-41.
- Haque R, Usmani O, Barnes P. Chronic idiopathic cough: a discrete clinical entity? *Chest* 2005;127:1710-3.
- Ryan NM, Vertigan AE, Bone S, Gibson PG. Cough reflex sensitivity improves with speech language pathology management of refractory chronic cough. *Cough* 2010;6:1-8.
- Ryan N, Vertigan A, Gibson P. Chronic cough and laryngeal dysfunction improve with specific treatment of cough and paradoxical vocal fold movement. *Cough* 2009;5:4.
- Vertigan A. Speech pathology management of chronic cough. *Acquir Knowl Speech Lang Hear* 2001;3:62-6.
- Gay M, Blager F, Bartsch K, Emery C. Psychogenic habit cough: review and case reports. *J Clin Psychiatry* 1987;48:483-6.
- Murry T, Tabae A, Aviv J. Respiratory retraining of refractory cough and laryngopharyngeal reflux in patients with paradoxical vocal fold movement disorder. *Laryngoscope* 2004;114:1341-5.
- Vertigan A, Theodoros D, Gibson PG, Winkworth A. Efficacy of speech pathology management for chronic cough: a randomised placebo controlled trial of treatment efficacy. *Thorax* 2006;61:1065-9.
- Chamberlain SAF, Garrod R, Clark L, Douiri A, Parker SM, Ellis J, et al. Physiotherapy, and speech and language therapy intervention for patients with refractory chronic cough: a multicentre randomised control trial. *Thorax* 2016;72:129-36.
- Mazzone SB, McGovern AE, Yang SK, Woo A, Phipps S, Ando A, et al. Sensorimotor circuitry involved in the higher brain control of coughing. *Cough* 2013;9:1745-9974.
- Leech J, Mazzone SB, Farrell MJ. Brain activity associated with placebo suppression of the urge-to-cough in humans. *Am J Respir Crit Care Med* 2013;188:1069-75.
- Vertigan AE, Gibson PG. Chronic refractory cough as a sensory neuropathy: evidence from a reinterpretation of cough triggers. *J Voice* 2011;25:596-601.
- Slovarp L, Loomis BK, Glaspey A. Assessing referral and practice patterns of patients with chronic cough referred for behavioral cough suppression therapy. *Chron Respir Dis* 2018;15:296-305.
- Vertigan AE, Kapela SM, Kearney EK, Gibson PG. Laryngeal dysfunction in cough hypersensitivity syndrome: a cross-sectional observational study. *J Allergy Clin Immunol Pract* 2018;3:30292-7.
- Vertigan A, Theodoros D, Gibson P, Winkworth A. Voice and upper airway symptoms in people with chronic cough and paradoxical vocal fold movement. *J Voice* 2007;21:361-83.
- Hartley NA, Petty BE, Johnson B, Thibeault SL. Comparative analysis of clinical profile: chronic cough vs paradoxical vocal fold motion. *Respir Med* 2015;109:1516-20.
- Van Houtte E, Van Lierde K, Claeys S. Pathophysiology and treatment of muscle tension dysphonia: a review of the current knowledge. *J Voice* 2011;25:202-7.
- Dromey C, Nissen SL, Roy N, Merrill RM. Articulatory changes following treatment of muscle tension dysphonia: preliminary acoustic evidence. *J Speech Lang Hear Res* 2008;51:196-208.
- Altman KW, Atkinson C, Lazarus C. Current and emerging concepts in muscle tension dysphonia: a 30-month review. *J Voice* 2005;19:261-7.
- Van Lierde KM, De Bodt M, Dhaeseleer E, Wuyts F, Claeys S. The treatment of muscle tension dysphonia: a comparison of two treatment techniques by means of an objective multiparameter approach. *J Voice* 2010;24:294-301.
- Halvorsen T, Walsted ES, Bucca C, Bush A, Cantarella G, Friedrich G, et al. Inducible laryngeal obstruction: an official joint European Respiratory Society and European Laryngological Society statement. *Eur Respir J* 2017;50:1602221.
- Hull JH, Backer V, Gibson PG, Fowler SJ. Laryngeal dysfunction: assessment and management for the clinician. *Am J Respir Crit Care Med* 2016;194:1062-72.
- Chamberlain S, Birring SS, Garrod R. Nonpharmacological interventions for refractory chronic cough patients: systematic review. *Lung* 2014;192:75-85.
- Vertigan AE, Gibson PG, Theodoros DG, Winkworth AL. A review of voice and upper airway function in chronic cough and paradoxical vocal cord movement. *Curr Opin Allergy Clin Immunol* 2007;7:37-42.
- Vertigan AE, Kapela SL, Ryan NM, Birring SS, McElduff P, Gibson PG. Pregabalin and speech pathology combination therapy for refractory chronic cough: a randomized controlled trial. *Chest* 2016;149:639-48.
- Patel A, Watkin G, Willig B, Mutalithas K, Bellas H, Garrod R, et al. Improvement in health status following cough-suppression physiotherapy for patients with chronic cough. *Chron Respir Dis* 2011;8:253-8.
- Smith JA, Haines J, Yorke J. Taming chronic cough. *Thorax* 2017;72:103-4.
- Vertigan A, Gibson PG. *Speech Pathology Management of Chronic Refractory Cough and Related Conditions*. Oxford: Compton Publishing; 2016.
- Slovarp L, Loomis BK, Glaspey A. Assessing referral and practice patterns of patients with chronic cough referred for behavioral cough suppression therapy. *Chron Respir Dis* 2018;15:296-305.