Complications of Cough
ACCP Evidence-Based Clinical Practice Guidelines

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Objectives: To review the spectrum and frequency of complications associated with coughing.
Design/methodology: Ovid MEDLINE literature review (through March 2004) for all studies published in the English language, including case series and case reports, since 1966 using the MeSH terms “cough” and “complications.”
Results: The complications of cough appear to stem from physiologic events. The magnitude of pressures, velocities, and energy that is generated during vigorous coughing allow coughing to be an effective means of clearing the airways of excessive secretions and foreign material, and providing cardiopulmonary resuscitation; however, they can also cause a variety of profound physical and psychosocial complications. The adverse occurrences include cardiovascular, constitutional, GI, genitourinary, musculoskeletal, neurologic, ophthalmologic, psychosocial, respiratory, and skin complications, and a decrease in health-related quality of life.
Conclusions: Knowledge of the spectrum of complications should enable clinicians to appreciate (1) the impact of cough on patients, (2) why it is imperative to exhaust all possible diagnostic and therapeutic options to eliminate cough, and (3) why it is inappropriate to minimize a patient’s complaint of cough and/or advise him/her to “live with it.”

Key words: cardiovascular; constitutional symptoms; GI; genitourinary; musculoskeletal; neurological; ophthalmologic; psychosocial; quality of life; respiratory; skin

Abbreviation: CQLQ = cough-specific quality-of-life questionnaire

The complications of cough stem from physiologic events. It is thought that there are usually three phases involved in the cough mechanism.1 The first is an inspiratory phase, which ends before closure of the glottis; the second is a compressive phase that is characterized by contraction of thoracic and abdominal musculature against a fixed diaphragm; and the third is an expiratory phase, which consists of the rapid expulsion of air when the glottis opens. The result of these actions is the production of sufficiently high expiratory velocity to dislodge and expel secretions or foreign bodies.

During the compressive and expiratory phases, cough can be described as a modified Valsalva maneuver.2,3 Cough can also be accompanied by a reflex increase in vagal tone.4,5 Furthermore, during vigorous coughing, intrathoracic pressures of up to 300 mm Hg6 and expiratory velocities of up to 28,000 cm/s, or 500 miles per hour (85% of the speed of sound),7 may be generated. Coughing produces hemodynamic changes that compare favorably to chest compressions. During the expiratory phase of a vigorous cough, systolic pressures approach 140 mm Hg, compared with 75 mm Hg during chest compressions.8 It has been estimated that a vigorous cough can generate from 1 to 25 J of energy.9 While the pressures, velocities, and energy of these magnitudes allow coughing to be an effective means of clearing the airways of excessive secretions and foreign material, and of providing cardiopulmonary resuscitation, they also can cause a variety of profound physically and psychosocially adverse occurrences that have the potential to lead to a significant decrease in health-related quality of life.

Knowledge of these complications should help clinicians to appreciate (1) the impact of cough on
patients, (2) why it is imperative to exhaust all possible diagnostic and therapeutic options to eliminate cough, and (3) why it is inappropriate to minimize a patient’s complaint of cough and/or advise him/her to “live with it.”

**Spectrum of Complications**

The adverse occurrences include cardiovascular, constitutional, GI, genitourinary, musculoskeletal, neurologic, ophthalmologic, psychosocial, respiratory, and skin complications, and a decrease in health-related quality of life (Table 1). This spectrum of complications was determined with the aid of an Ovid MEDLINE literature review (through March 2004) for all studies published in the English language, including case series and case reports, since 1966 using the MeSH terms “cough” and “complications.” With the exception of the referenced literature on health-related quality of life, the quality of evidence for the majority of complications displayed in Table 1 consisted pri-

<table>
<thead>
<tr>
<th>Variables</th>
<th>Symptoms</th>
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<tr>
<td>Cardiovascular</td>
<td>Arterial hypotension&lt;sup&gt;3,6,18–21&lt;/sup&gt; Bradyarrhythmias&lt;sup&gt;4,5&lt;/sup&gt; and tachyarrhythmias&lt;sup&gt;22,23&lt;/sup&gt; Dislodgement/malfunctioning of intravascular catheters&lt;sup&gt;24&lt;/sup&gt; Loss of consciousness&lt;sup&gt;18,16–21&lt;/sup&gt; Rupture of subconjunctival, nasal, and anal veins&lt;sup&gt;6,25&lt;/sup&gt; and massive intraocular suprachoroidal hemorrhage during pars plana vitrectomy&lt;sup&gt;26&lt;/sup&gt;</td>
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<td>Constitutional symptoms</td>
<td>Excessive sweating, anorexia, exhaustion&lt;sup&gt;25,27&lt;/sup&gt;</td>
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<td>GI</td>
<td>Gastroesophageal reflux events&lt;sup&gt;27&lt;/sup&gt; Gastric hemorrhage following percutaneous endoscopic gastrostomy&lt;sup&gt;29&lt;/sup&gt; Hepatic cyst rupture&lt;sup&gt;30&lt;/sup&gt; Herniations (eg, inguinal,&lt;sup&gt;31&lt;/sup&gt; through abdominal wall,&lt;sup&gt;32&lt;/sup&gt; small bowel through laparoscopic trocar site&lt;sup&gt;33&lt;/sup&gt;) Malfunction of gastrostomy button&lt;sup&gt;34&lt;/sup&gt; Mallory-Weiss tear&lt;sup&gt;35&lt;/sup&gt; Splenic rupture&lt;sup&gt;36&lt;/sup&gt;</td>
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<tr>
<td>Genitourinary</td>
<td>Inversion of bladder through urethra&lt;sup&gt;37&lt;/sup&gt; Urinary incontinence&lt;sup&gt;11,27&lt;/sup&gt;</td>
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<td>Musculoskeletal</td>
<td>From asymptomatic elevations of serum creatine phosphokinase to rupture of rectus abdominus muscles&lt;sup&gt;25,38–44&lt;/sup&gt; Diaphragmatic rupture&lt;sup&gt;45,46&lt;/sup&gt; Rib fractures&lt;sup&gt;47–52&lt;/sup&gt; Sternal wound dehiscence&lt;sup&gt;53&lt;/sup&gt;</td>
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<td>Neurological</td>
<td>Acute cervical radiculopathy&lt;sup&gt;24&lt;/sup&gt; Cerebral air embolism&lt;sup&gt;55&lt;/sup&gt; Cerebral spinal fluid rhinorrhea&lt;sup&gt;56,57&lt;/sup&gt; Cervical epidural hematoma associated with oral anticoagulation&lt;sup&gt;58&lt;/sup&gt; Cough syncope&lt;sup&gt;19–21,59–64&lt;/sup&gt; Dizziness&lt;sup&gt;27&lt;/sup&gt; Headache&lt;sup&gt;65–68&lt;/sup&gt; Malfunctioning ventriculoatrial shunts&lt;sup&gt;59&lt;/sup&gt; Seizures&lt;sup&gt;70&lt;/sup&gt; Stroke due to vertebral artery dissection&lt;sup&gt;71&lt;/sup&gt;</td>
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<td>Ophthalmologic</td>
<td>Spontaneous compressive orbital emphysema of rhinogenic origin&lt;sup&gt;72&lt;/sup&gt; Others are listed under “Cardiovascular”</td>
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<td>Psychosocial</td>
<td>Fear of serious disease&lt;sup&gt;10,12,27&lt;/sup&gt; Lifestyle changes&lt;sup&gt;10,12,27&lt;/sup&gt; Self-consciousness&lt;sup&gt;10,12,27&lt;/sup&gt;</td>
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<td>Quality of life</td>
<td>Decreased&lt;sup&gt;10,12,13&lt;/sup&gt;</td>
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<td>Respiratory</td>
<td>Exacerbation of asthma&lt;sup&gt;73&lt;/sup&gt; Herniations of the lung (eg, intercostal&lt;sup&gt;74–76&lt;/sup&gt; and supraclavicular&lt;sup&gt;77&lt;/sup&gt;) Hydrothorax in peritoneal dialysis&lt;sup&gt;78&lt;/sup&gt; Laryngeal trauma (eg, laryngeal edema&lt;sup&gt;79,90&lt;/sup&gt; and hoarseness&lt;sup&gt;10,12,27&lt;/sup&gt;) Pulmonary interstitial emphysema, with potential risk of pneumatois intestinalis, pneumomediastinum, pneumoperitoneum, pneumoretroperitoneum, pneumothorax, subcutaneous emphysema&lt;sup&gt;81–84&lt;/sup&gt; Tracheobronchial trauma (eg, bronchitis&lt;sup&gt;25&lt;/sup&gt; and bronchial rupture&lt;sup&gt;85&lt;/sup&gt;)</td>
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<td>Skin</td>
<td>Petechiae and purpura&lt;sup&gt;96&lt;/sup&gt; Disruption of surgical wounds&lt;sup&gt;25&lt;/sup&gt;</td>
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Cough and Health-Related Quality of Life

The health-related quality of life of patients complaining of acute and chronic cough is adversely affected, and this is the most likely reason why these patients seek medical attention. Four studies\textsuperscript{10–13} have prospectively shown that cough can adversely affect health-related quality of life. In chronicologic order, the first study\textsuperscript{10} utilized the Sickness Impact Profile, a non-illness-specific measure of health-related dysfunction that had been modified to measure the effects of patients' chronic cough on the performance of usual daily activities. The health-related dysfunction of patients with chronic cough is most likely to be psychosocial in nature. While the Sickness Impact Profile had not been psychometrically tested to assess the effects of cough, it revealed, in a before-and-after treatment intervention trial, that chronic cough was associated with a significant deterioration in patients' quality of life, and that the health-related dysfunction was most likely due to psychosocial factors.\textsuperscript{12}

The second study\textsuperscript{11} utilized a cough-specific quality-of-life questionnaire (CQLQ) that assessed the 28 most common reasons why patients seek medical attention because of coughing. It has been shown to be a reliable and valid tool for evaluating the impact of acute and chronic cough on adult patients, and a valid method by which to assess the efficacy of cough therapies for chronic cough. A comparison of total CQLQ scores of both chronic and acute coughers\textsuperscript{10} showed that, while the scores were similar to each other, they were both significantly higher than those for a control group of smokers who were not complaining of cough. Compared to the control subjects, patients with chronic cough complained significantly more of physical complaints (eg, lost appetite, headaches, dizziness, sweating, hoarseness, hurts to breathe, insomnia, ache all over, and exhaustion), psychosocial issues (eg, family cannot tolerate it, difficulty speaking on phone, embarrassment, upset because others think I have something wrong, and self-consciousness), functional ability impairments (eg, prolonged absences from important activities, cannot engage in important activities, cannot sing, stopped going to social activities, and had to change lifestyle), issues that adversely affected their emotional well-being (eg, fear of tuberculosis or AIDS, soiled pants, and broke a rib), extreme physical complaints (eg, sick to stomach and vomiting, retching, wet pants, and soil pants), and personal safety fears (eg, concern about cancer, want to be reassured that nothing is seriously wrong, and concern that there is something seriously wrong).

The third study\textsuperscript{13} utilized the Leicester cough questionnaire, which assessed 19 items that the investigators found were troublesome to patients with chronic cough. Psychometric testing revealed the Leicester cough questionnaire to be a valid and repeatable quality-of-life measure of chronic cough that is responsive to change.\textsuperscript{13}

The fourth study\textsuperscript{14} utilizing the CQLQ in a study with a control group of smokers not complaining of cough to assess gender differences in health-related quality of life in patients complaining of chronic cough, determined that women with chronic cough were probably more inclined to seek medical attention than men because their health-related quality of life was significantly more adversely affected and because they were more apt to experience physical complaints such as stress urinary incontinence, which provoked psychosocial issues such as becoming embarrassed.\textsuperscript{11} Cough reflex sensitivity was not measured in this health-related quality-of-life study\textsuperscript{11} (or in the other three studies\textsuperscript{10,12,13} just reviewed). Consequently, while tussigenic inhalation challenges have shown that healthy women\textsuperscript{14} and women with chronic cough\textsuperscript{15} have lower cough thresholds than healthy men and men with chronic cough, it is not known whether this finding of higher cough reflex sensitivity contributes to the greater adverse effect on health-related quality of life. Women with chronic cough are probably more inclined to seek medical attention than men because their health-related quality of life is more adversely affected and because they are more apt to experience physical complaints such as stress urinary incontinence, which provoke psychosocial issues such as becoming embarrassed.

Recommendations

1. In patients complaining of cough, evaluate for a variety of complications associated with coughing (eg, cardiovascular, constitutional, GI, genitourinary, musculoskeletal, neurologic, ophthalmologic, psychosocial, and skin complications), which can lead to a decrease in a patient's health-related quality of life. Level of evidence, low; benefit, substantial; grade of recommendation, B

2. Patients with cough should have a thorough diagnostic evaluation, according to the guidelines set forth in this document, to mitigate or prevent these complications. Level of evidence, low; net benefit, substantial; strength of recommendation, B
Cough and the Risk of Coronary Artery Disease

Two large epidemiologic studies have provided evidence that chronic cough, as a clinical manifestation of pulmonary infection or chronic inflammation, is associated with an increased risk of coronary artery disease or myocardial infarction. The risks in both studies were independent of the known major cardiovascular risk factors. The risk was found to be increased in the Framingham Heart Study, whether or not the cough was productive or unproductive. Whether the association is causal can only be determined by additional and controlled studies.

Summary of Recommendations

1. In patients complaining of cough, evaluate for a variety of complications associated with coughing (eg, cardiovascular, gastrointestinal, genitourinary, neurologic, ophthalmologic, psychosocial, and skin complications), which can lead to a decrease in a patient's health-related quality of life. Level of evidence, low; benefit, substantial; grade of recommendation, B

2. Patients with cough should have a thorough diagnostic evaluation, according to the guidelines set forth in this document, to mitigate or prevent these complications. Level of evidence, low; net benefit, substantial; grade of recommendation, B

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