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Semantics and types of cough

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Abstract

The panel considered the different types of cough in terms of basic mechanisms and clinical manifestations; both experimentally and clinically cough could occur in single efforts and as ‘bouts’ or ‘epochs’. There were different definitions of cough but, provided the definition used was clear, this did not seem to be a major concern.

The methods available for determining the nature or type of clinical cough were discussed, in particular automated cough counting in the clinic and more sophisticated methods available in the laboratory. With regard to semantics, there has been great variation in the names used; this applies to nervous sensors for cough, to cough reflexes and epochs, to clinical names for cough, and to cough sounds. Some simplification and uniformity of nomenclature seemed desirable although, provided the use of a name was clear, little confusion probably existed. The panel felt that the cough nomenclature would evolve with time and would prove to be useful for investigators, clinicians and coughers.

Keywords

Cough; Cough reflexes; Cough types; Cough semantics; Cough sounds

1. Introduction

The discussion was introduced by John Widdicombe. He pointed out that there were contradictory definitions of cough, and that each definition probably had merit provided it was clear, and its uses and limitations identified. No-one would disagree that there were different ‘types’ of cough (Table 1), as there were different physiological mechanisms and pathological causes, and that it would potentially be useful to identify, define and describe the different types of cough. The value of such an exercise is not known, and would not be known until it

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was assessed! Of course clinicians have always tried to diagnose the underlying conditions causing cough, and noted different features of cough, but there seems to be no clear consensus on the classification, mechanisms and nomenclature of these different types of cough. Furthermore the identification or classification of a type of cough may depend on the methods used, and these differ from laboratory to laboratory and clinic-to-clinic. The semantics of cough was a mess with no conformity. A simplified semantics with clear definitions might lessen confusion.

In many ways, we are in a situation where the field of dyspnoea was a few decades ago, when work started to define different types of abnormal sensation of dyspnoea [1,2]. Different types of dyspnoeic sensation are recognized (air hunger, chest discomfort/tightness, unrewarded breathing, rapid breathing, etc.) and this helps to understand the patient's problem clinically, and to visualize pathophysiological mechanisms.

In the general discussion, many of the above areas were explored. There was no attempt to obtain a consensus, and the following is a summary of the topics discussed and of the views expressed.

2. Definitions of cough

It was pointed out that a recent European Respiratory Society (ERS) Task Force recommended two possible definitions of cough [3]: (1)'A three-phase expulsive motor act characterized by an inspiratory effort (inspiratory phase) followed by a forced expiratory effort against a closed glottis (compressive phase) and then by opening of the glottis and rapid expiratory airflow (expulsive phase)'. This definition appears in most textbooks, which sometimes add a fourth 'recovery phase' (the deep inspiration that usually follows a cough). (2) 'A forced expiratory manoeuvre, usually against a closed glottis and associated with a characteristic sound'. The case for the latter definition has been strongly argued by Morice [4]. While no strong preference was expressed by the ERS Task Force for either definition (although they clearly have incompatible features, and some would argue that a closure of the glottis is essential for the definition of a cough and for the characteristic expulsive sound), the first definition was thought appropriate for laboratory and analytical studies, and the second as a convenient method for assessing a main feature of cough in the clinic.

3. Types of cough

In the clinic coughs are usually identified by their cause, e.g. due to gastro-oesophageal reflux, asthma, postnasal drip, etc., or are termed idiopathic. They may be defined by their characteristics, e.g. wet, moist, hacking or chesty, terms that cannot be scientifically identified or quantitated (Table 1). They may be acute, subacute or chronic, with arbitrary but generally accepted definitions of the duration of each type of cough. They may be isolated coughs or occur in epochs (see later). They may arise from the airways due to respiratory disease or from the cerebral cortex, e.g. habit and voluntary coughs. The latter cannot be studied in subhuman animals; nor can the sensation of urge-to-cough [5,6]. These various patterns of cough have been discussed [7]. Studies of these topics with humans urgently need extension.

In the laboratory, types of cough may be more clearly defined, in particular the distinction between 'true' cough and the expiration reflex, the latter resembling cough but without the initial inspiratory phase [8–10]. The highly complex neural mechanisms of cough, involving different nervous sensors, different membrane receptors, different brainstem pathways, and different physiological and pharmacological processes have been extensively studied in subhuman animals, and have led to a vast literature (reviewed in Refs. [11–13]). However these basic physiological results have hardly been applied to human and clinical conditions although it is clear that different coughers have different patterns of cough [8,9], and that voluntary and

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induced reflex coughs may have different muscular activities [14]. The panel recognized this gap between basic and clinical studies on cough, and hoped that it could be narrowed.

4. Clinical analysis of cough

The only convenient way of quantitating clinical cough is by cough counts, and sophisticated automated methods to do this, by audiovisual recordings, have been developed [15–17]. However these recordings are restricted to identifying expulsive sounds and do not assess cough intensity (since sound intensity need not correlate with muscle contraction or pressure intensities), and this latter variable may be of more relevance to the patient than cough expulsive frequency. The use of cough questionnaires [18,19] may be helpful here, but they do not give objective values.

Automated cough counting also does not readily allow a distinction between isolated coughs and cough 'epochs' although, given an arbitrary definition of an epoch (e.g. expulsive efforts separated by a small defined arbitrary time interval [20]), this approach is possible. The difference may be important to the patient, who may be less distressed by five separated expulsive efforts over 2 min than by an epoch of five similar efforts within 10 s.

Some more sophisticated analyses of clinical cough can include pressures, airflows and abdominal muscle electromyograms which may provide a measure of the severity or the intensity of cough (e.g. [14,21]), but these may be more appropriate to a research laboratory than to an investigative clinic.

The durations of clinical cough (acute, subacute and chronic) have been given clear definitions that are generally accepted. The timing of cough events, for example when they follow certain triggers or stimuli, is also an important aspect that may point to a diagnosis (Table 1).

In general the panel agreed that the assessment of clinical cough would greatly benefit by the development and introduction of more advanced methods of analysis, provided these were readily applicable in the clinic. They would aid the integration of basic studies on cough with those in the clinic and the better understanding of types of cough in the clinic, and could point to different therapies for different types of cough.

5. Semantics of cough

Having dealt with weighty matters concerning cough in the laboratory and clinic, the discussion turned to a lighter (but probably still important) matter: semantics.

5.1. Cough receptors

Various names have been given to the nervous sensors thought to mediate cough from the larynx, lower airways and lungs. The terms 'irritant receptors' and 'rapidly adapting receptors (RARs)' have been much used in the past [22], but the former term is now seldom used for lower airway sensors, and the latter term may oversimplify a complex system. 'Juxta-pulmonary capillary receptors' or 'type-J receptors', referring to alveolar sensors with non-myelinated afferent fibres thought to cause cough, had a vogue [23], but has now been generally replaced by 'pulmonary C-fibre receptors', and their mediation of cough has been strongly disputed [24], as has that of bronchial C-fibre receptors [25]. Recent definitive reviews have identified four sensor types thought to mediate cough: Aδ-nociceptors, 'cough receptors', C-fibre nodose receptors and C-fibre jugular receptors [11–13]. These studies apply mainly to guinea pigs, and their relevance to other species has not been determined. Receptors in the larynx mediating cough and the expiration reflex have been analysed less than have those in the lower airways, and are still usually referred to as 'irritant receptors' [22]. Since 'receptor'

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is a term long used to identify membrane structures which, when activated, excite or inhibit the nerve terminal in which they reside, a case could be made for calling the sensory nervous structures ‘sensors’, and this seems to be increasingly done; thus a nerve ‘sensor’ may have many ‘receptors’ in its membrane.

5.2. Cough reflexes

In subhuman animals the distinction between the ‘true’ cough reflex and the ‘expiration reflex’ is clear [9,10,26], as are their functions: the former to clear material from the lower airways and lungs, and the latter to prevent its entry [9]. Their separate patterns in humans have been analysed [8], but they are rarely separated in the vast literature on chronic cough. If the patterns, and others, can be identified they should have appropriate names; at present they are all grouped together under ‘cough’.

Cough epochs have also been called ‘bouts’, ‘bursts’, ‘attacks’, ‘peals’ and ‘peels’; the last, although regrettably common recently (e.g. [4,27]), is clearly a misspelling of the euphonious ‘peal’ and should be abandoned. More important is that the epoch is rarely defined. However they have recently been analysed in humans [8,20], and also given a clear, if arbitrary, definition [20].

5.3. Cough in the clinic

It was suggested (by Paul Davenport) that cough might be classified under the names eutussia (normal cough), dystussia (pathological), atussia (absent), hypotussia (weakened) and hypertussia (sensitized) (Table 1). Support for this approach appears in a recent study of cough in stroke patients [28]. There was no dissent from this suggestion, which clearly needs further consideration. This type of classification assumes that we can indeed distinguish a ‘normal’ cough from a ‘pathological’ cough, and presumably this would be clarified after investigation of the patient’s cough. Similarly, the term ‘sensitized’ cough might be judged to apply to all pathological coughs (since many coughs are not symptoms associated with health). Otherwise the diagnosis of a sensitized cough would presume the presence of a positive cough response to capsaicin or a similar tussive agent, unless the presence of a cough precipitated by deep breath, laughing or certain odours is a good indicator of ill health [29].

5.4. Cough sounds

Cough sounds also have many names. The first sound may be ‘expulsive’ or ‘explosive’; the second ‘glottal or ‘voiced’; the third and other sounds, if and when they exist, are seldom referred to. A recent harmonic analysis of some cough sounds [20] has identified interesting features, some of which had been detailed in earlier and little quoted research (e.g. [30]). For example a second cough sound appeared to be an almost pure harmonic at F^4 [20], and it was suggested facetiously that it might be named a ‘sungsound’.

Table 1 lists some of the types, names and characteristics of cough in the clinic. It illustrates the diversity of clinical cough; a few of the types have been defined but the neural basis of most of them is uncertain. The list is incomplete, and it is given in order to illustrate the complexity and variability of causes of cough, and our ignorance about the mechanisms of most of them.

6. Conclusions

The above summary identifies the topics that were discussed by the panel and audience. No voices were raised in vigorous dissent during the discussions, and there were no votes either by the panel or the audience. The impression was given that these matters were worth raising, worth discussing and worth considering further.

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The view has been expressed that it didn't much matter what you call cough or any of its aspects, provided your definition is clear, you stick to the definition, and you try to understand what you were talking about [31]. No-one openly disagreed. However, if there is to be further progress, we would need to do further work in (1) understanding the language and descriptors of cough from patients; (2) understanding the correlates of cough variables to these descriptors; (3) understanding the peripheral sensor and brainstem neural mechanisms that lead to various patterns of cough in patients; and (4) investigating the influence of the higher centres on the control of cough.

There were no takers for chairing a Committee on Cough Nomenclature, to the relief of the panel! This would have been an unnecessary bureaucratic task since nomenclature of cough will develop through usage rather than through the imposition of rules or decrees. Perhaps the next Symposium will give a chance to revisit the semantics of cough, and to see if there had been evolution.

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Table 1

A short list of different types, names and characteristics of cough, including in the clinic.

1. Behavioural types of cough				
Mainly at night			Mainly during the day	
On lying down			On arising	
On bending down			On straightening up	
Triggered by cold			Triggered by heat	
During ingestion of food			After ingestion of food	
Caused by dusts and irritants			Caused by odours and perfumes	
Throat clearing			Attention seeking	
Habit cough (psychogenic)			With tics (Tourette-like)	
Triggered by deep breath			Triggered by laughter	
Urge-to-cough			Voluntary cough	
2. Descriptions of pathological cough (before specific diagnosis)				
Bovine	Dry	Moist	Hacking	Whooping
Throat irritation		Chest irritation		Nasal drip
3. Durations of cough				
Acute		Subacute		Chronic
4. Effects of cough				
Syncope		Urinary incontinence		Rib fracture
Pain/distress		Social embarrassment		Sleeplessness
5. Grades of cough				
Normal (Eutussia)	Sensitized (Hypertussia)	Desensitized (Hypotussia)	Pathological (Dystussia)	Absent (Atussia)