

TRACHEAL WHISTLES – A NEW PHYSICAL SIGN OF AIRWAY CONSTRICTION

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We describe a new class of wheezes that are only detectable over the trachea and have a frequency range that is too high (i.e. 1500 to 4000 Hz) to be detected by stethoscopic auscultation. We propose the term “Respiratory Whistles” to describe this new kind of Continuous Adventitious Breath Sounds.

Methods. Contact phonopneumography (PPG) sensors with broad frequency response (50 to >4,000 Hz) were applied with adhesive pads over the tracheae of 45 asthmatic patients during regular clinic visit (n=12) and during methacholine bronchial provocation test (BPT) (n=33). The whistles were detected by an automatic wheeze detection device (PulmoTrack® Model 1010, Karmel Medical, Yokneam Illit, Israel) and were confirmed by playback of recorded sounds to expert physicians.

Results. Respiratory whistles were found in 27 (60%) of the asthma patients during bronchoconstriction. Whistles were not present in non-asthmatics. Whistles were not present in the asthmatics when they were not bronchoconstricted, and they disappeared after administration of inhaled bronchodilator (Albuterol). Whistles differ from wheezes by their properties as outlined in the Table:

Property	Wheezes	Whistles
<i>Frequency range</i>	< 1500 Hz	>1500 Hz
<i>Location</i>	Trachea and chest wall	Only over trachea
<i>Duration</i>	Long, 0.4 to 2 sec	Short, < 0.4 sec
<i>Timing</i>	Throughout the breath	Beginning and end
<i>Frequency Dependence on flow rate</i>	Stable frequency with minor changes	Frequency increases with flow rate
<i>Frequency stability</i>	Stable frequency	High frequency variability
<i>Airways status</i>	Substantial constriction	Mild constriction

Discussion. Respiratory whistles constitute a new physical sign of bronchoconstriction. They are distinctly different from wheezes and are probably generated by a different mechanism that is not related to flow-limitation (e.g. phased-locked turbulent shedding of eddies). Respiratory whistles are detected only over the tracheae of bronchoconstricted subjects when broad frequency acoustic sensors are used.

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