



Short Communication

Copyright© Madhu Varma MD

Use of Tracheal Breath Sounds in Respiratory System Auscultation Simulation

Madhu Varma MD*

Department of Medical Education and Clinical Skills, California University of Science and Medicine, USA

*Corresponding author: Madhu Varma MD, Department of Medical Education and Clinical Skills, California University of Science and Medicine, USA.

To Cite This Article: Madhu Varma MD*, Tracheal Respiratory System Auscultation in Age of Simulation. Am J Biomed Sci & Res. 2024 21(5) AJBSR.MS.ID.002885, DOI: [10.34297/AJBSR.2024.21.002885](https://doi.org/10.34297/AJBSR.2024.21.002885)

Received: 📅 : February 28, 2024 ; Published: 📅 March 05, 2024

Abstract

Clinical examination skills are an essential component to making accurate diagnosis and creating assessment plans for investigations and further patient management. These skills allow physicians to determine which observations are part of normal anatomy and physiology, and which are occurring due to underlying pathology that is creating the altered presentation.

Introduction

Many medical schools are increasingly using simulation and standardized patients (SP) to teach clinical skills. This method allows students to get comfortable with patient interactions, learn examination techniques that help them have more confident actual patient interactions. Further teaching the art of history taking and fine techniques of clinical examination to pre-clinical students helps to develop their critical clinical reasoning skills [1]. One of the drawbacks to using SPs is that students learn what is normal examination but have a hard time imagining what to expect when it is abnormal.

In the pulmonary system, students are taught inspection, palpation, percussion, and auscultation along with special tests of bronchophony, egophony and whispering pectoriloquy to determine what the underlying abnormal lung pathology could be [2]. Auscultation is important in assessing airflow through the tracheo-bronchial tree. Physicians utilize the sounds produced in the lung (tracheobronchial tree) and larynx, (vocal sounds) to determine underlying pathology based on the quality/ timbre and intensity of sound.

The correct technique of performing pulmonary auscultation is with a patient sitting up and taking deep breaths through the mouth. The examination is done in a ladder pattern comparing the two sides, starting from the apices, and moving down covering all lung lobes, anteriorly and posteriorly.

The normal vesicular breath sounds heard during auscultation are better heard during inspiration than expiration. Vesicular breath sounds are generated by the turbulence created by air flowing through large diameter airways such as trachea into smaller bronchioles. Further branching of the bronchioles creates whirlpools in airflow increasing the turbulence. These whirlpools normally are generated between the 5-13th generation of bronchioles. Although the normal breath sound is called vesicular implying it is generated in the alveoli, the sound is generated in the smallest bronchioles. Any change in diameter of airway such as happening with bronchospasm as seen in asthma and bronchitis increases turbulence and hence gives the patient noisy inspiratory breathing.

Besides examining the lung sounds on auscultation, one also must examine the voice/ vocal sounds produced by the larynx. Sound is produced by bursts of air passing through the vocal cords producing vibrations. The voice sounds are not produced by the lung but are significantly impacted by changes in the lung. Normally voice sounds are of low intensity and timbre in healthy adults, almost inaudible to the human ear. In the presence of fluid or solid mass that replaces air in the lungs, these sounds get modified. So, when the lung undergoes consolidation, has a mass, atelectasis, pleural effusion the sound is significantly amplified and distinctly heard on lung auscultation and palpation. Imagine blowing air through a straw in a soda can. As the air bubbles it produces bubbly sounds that are called crackles. Crackles are heard when there is fluid in lungs or in presence of atelectasis. In presence of pleural ef-

fusion the sounds are decreased / muffled, while in the presence of consolidation breath sounds are increased. Vocal sounds are tested by doing three special tests of bronchophony, egophony and whispering pectoriloquy.

During bronchophony, the patient is asked to repeat the number “ninety-nine” while the physician auscultates. If consolidation is present then this sound is increased in intensity and timbre/clarity, and if pleural effusion is present this sound is decreased. In egophony, a patient is asked to say the long “EEE” during auscultation. If patient has consolidation the “EEE” sounds more like the bleating of a goat and sounds like an “A”, indicating the presence of consolidation. This happens because the vowel “E” is made up of both high frequency and low frequency sounds. With consolidation only the low frequency sounds of “EEE” that are like “A” is transmitted. So, EEE becomes an A during solidification of lung parenchyma as seen in presence of mass, or consolidation in pneumonia.

In whispering pectoriloquy, the patient whispers 123 and if consolidation is present these sounds are magnified. In pleural effusion these sounds get muffled.

Students often must wait to hear these sounds in actual patients. While in their formative preclinical years, students feel a bit overwhelmed as to the mystery of these sounds and feel nervous about this examination, since they do not know what to expect in actual patient encounters. This also leads to decreased aptitude towards clinical examination leading to poor critical thinking, poor differential diagnosis and increased financial burden of investigations [3].

An easy fix to this is simulation of breath sounds on the trachea. Demonstration is given to students as to what normal vesicular breath sounds sound like on auscultation on the lung, followed by lightly placing the stethoscope on the trachea where they will hear what bronchial breath sound sounds like. Students can do this examination on themselves, or standardized patients when available.

Similarly, the tests of bronchophony/ vocal fremitus, egophony and whispering pectoriloquy can successfully be demonstrated with gentle auscultation of the trachea. These auscultatory demonstrations help students learn and understand what to expect in different pulmonary pathologies, without the use of expensive simulation mannequins.

Although some researchers believe that Clinical skills are a dying art [4,5], if correct technique is used, the majority of the diagnosis can be made clinically. Pulmonary auscultation is high yield and teaches students what different vocal and lung sounds sound like during health and disease, adding value to clinical experiential learning and decreasing student anxiety regarding this examination.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Danielson AR, Venugopal S, Mefford JM, Clarke SO (2019) How do novices learn physical examination skills? A systematic review of the literature. *Med Educ Online* 24(1): 1608142.
2. Elder AT, McManus IC, Patrick A, Nair K, Vaughan L, et al. (2017) The value of the physical examination in clinical practice: an international survey. *Clin Med (Lond)* 17(6): 490-498.
3. Asif T, Mohiuddin A, Hasan B, Pauly RR (2017) Importance of thorough physical examination: a lost art. *Cureus* 9(5): e1212.
4. Uddin KN (2019) The lost art of clinical skills. *BIRDEM Medical Journal* 9(2): 102-105.
5. Rawles Z, Griffiths B, Alexander T (2017) *Physical examination procedures for advanced practitioner and non-medical prescribers. Evidence and rationale* 2nd edition.