

# JoVE: Science Education

## General Approach to Percussion in the Physical Exam

--Manuscript Draft--

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## Overview

Simply stated, percussion refers to the striking of one object against another to produce sound (**Figure 1**). In the early 1700s, an Austrian inn-keeper's son, named Leopold Auenbrugger, discovered he could take inventory by tapping his father's beer barrels with his fingers (**Figure 2**). Years later, while practicing medicine in Vienna, he applied this technique to his patients and published the first description of the diagnostic utility of percussion in 1761. His findings faded into obscurity until the prominent French physician Jean-Nicolas Corvisart (**Figure 3**) rediscovered his writings in 1808, during an era in which great attention was focused on diagnostic accuracy at the bedside (Nuland, 1988).

There are three types of percussion. Auenbrugger and Corvisart relied on direct percussion, in which the plexor (i.e., tapping) finger strikes directly against the patient's body. An indirect method is used more commonly today. In indirect percussion, the plexor finger strikes a pleximeter, which is typically the middle finger of the non-dominant hand placed against the patient's body. As the examiner's finger strikes the pleximeter (or directly against the surface of the patient's body), sound waves are generated. If using indirect percussion, important information is gained from the vibration in the pleximeter finger, as well (McGee, 2012). The third type of percussion, auscultatory percussion, relies on the clinician using a stethoscope to discern differences in sounds created by the plexor finger. Since direct and auscultatory percussion are infrequently utilized, they are not covered in this video.

The density of the structure underlying the site of percussion determines the tone of the percussion note; the denser the structure, the quieter the note. Notes differ in relative intensity, pitch, and duration, and help the examiner determine what lies below the skin surface. Knowledge of what particular locations on the body should sound like, in conjunction with the particulars of a specific clinical situation, can help a clinician determine if percussion notes in a particular patient are normal or not.

## Procedure

1. Before the patient encounter:

1.1 Keep fingernails clean, groomed, and trimmed.

1.2 Wash your hands with soap and water or topical disinfectant solution.

1.3 Warm your hands as able (e.g., with warm water or by rubbing them together) before patient contact.

2. Components of the exam.

**Comment [AS1]:** This overview is a little longer than usual and has historical information. Given the introductory premise of this manuscript (and, actually, the whole of Dr. Talwalkar's section), I think it is justified to keep the first paragraph as a part of the script. The historical perspective worked great for the Neuroscience science education collection, so I think it could work here, as well. Plus, there are many videos on percussion – but none presented in this way! For your consideration. AS

In theory, percussion can be utilized on any part of the body, but it is clinically most useful in the examinations of the chest and abdomen. Refer to the individual videos for these regions to learn about how percussion is specifically utilized.

### 3. Indirect percussion.

3.1 Establish a pleximeter by placing the middle finger of your non-dominant hand firmly against the body surface being examined.

3.2 Make sure the entire distal phalanx is in contact with the patient, but the rest of the fingers are not, and the other fingers are splayed out to avoid making contact with the patient, which could dampen the sound.

3.3 Using a quick, relaxed, snapping motion from the wrist, strike the distal interphalangeal joint of the pleximeter finger with the tip of the middle finger on your dominant hand. This is the plexor finger. The plexor finger should be lifted rapidly to avoid dampening the sound.

3.4 Familiarize oneself with the different percussion notes (**Table 1**). Gas-filled structures sound louder with longer notes, while solid structures create quieter, shorter notes. Liquid notes are typically between the gas-filled and solid structure notes. There are five common terms used to describe percussion notes in the physical examination: tympanitic, hyperresonant, resonant, dull, and flat.

3.4.1 Percuss over the abdomen. Gas-filled areas reveal the loud, high-pitched tympanitic note, as is commonly found over the stomach.

3.4.2 Percuss over the lungs. Normal lung tissue reveals a loud, low-pitched resonant note. Hyperresonance cannot be demonstrated on normal subjects, but it is found in lung diseases, such as emphysema or pneumothorax. It can be distinguished from resonance, because it is louder and lower-pitched.

3.4.3 Percuss the liver span. The dull percussion note heard over the liver is medium in intensity and pitch. The margins can be identified by a change in note, since a resonant note of normal lung tissue can be heard superior to the liver, and a tympanitic (or sometimes less dull) note can be heard inferiorly, due to the bowels.

3.4.4 A soft, high-pitched flat note is heard when the underlying tissue is dense, as is the case with pleural effusions or ascites. In a patient without these pathological processes, appreciate a flat note by percussing over the dense quadriceps muscles, though percussing in this location holds no clinical utility during a physical exam.

3.5 Note the amount of vibration in the pleximeter finger. Gas-filled structures allow for more movement of the pleximeter finger than liquid or solid structures. The differences are subtle and require keen attention and practice to appreciate.

3.6 Percuss at each point a few times in rapid succession to ensure consistency of notes before moving to the next spot.

4. Other factors affecting a percussion note:

4.1 Make sure percussion is done directly on the patient's skin. Any barrier between the examiner and the patient can alter findings in percussion. This is especially true regarding vibrations sensed by the pleximeter finger, which can be affected by clothing, gowns, and even examination gloves. If gloves are worn during this portion of the exam, the clinician must account for the difference in the way the percussion note feels on the pleximeter finger.

**Comment [TJ2]:** For this part we could have the examiner doing the exam while wearing gown and gloves.

4.2 Note that sounds can be augmented by applying more pressure with the pleximeter finger. Inadequate pressure with the pleximeter finger can cause artificial dullness. Striking more forcefully with the plexor finger is rarely helpful, though striking too lightly can also lead to artificial dullness.

4.3 Remember that percussion notes and vibrations on the pleximeter finger are impacted by subcutaneous fat, which dampens vibrations, leading to increased areas of dullness.

4.4 When moving around the area of the body being percussed (e.g., to establish liver span), maintain a consistency in exam technique. Keep a stable amount of pressure with the pleximeter finger and force with the flexor finger. Continue to strike the pleximeter finger at the same spot, using the same part of the plexor finger.

5. Fist percussion.

The maneuver can be performed directly against the patient's body, or indirectly with the examiner's non-plexor hand placed palm down on the patient's body wall, and the plexor fist striking the dorsum of the hand to attenuate the force of the blow. Direct or indirect percussion with the ulnar aspect of the examiner's fist is most commonly utilized to elicit tenderness originating from the kidneys, but can also be utilized to identify tenderness in other deep organs (e.g., the liver).

5.1 Deliver a quick, firm blow to the area of interest (e.g., costo-vertebral angle) with the ulnar aspect of a hand flexed gently into a fist. The examiner's motion is brisk, with movement originating at the elbow.

5.2 Use the same technique when searching for an area of tenderness. It is critical to deliver the right amount of force – enough to uncover tenderness in a patient with pathology, but not so much to cause undue discomfort or pain in a patient without disease.

## Summary

This video covers the general considerations related to percussion during the physical examination. The routine incorporation of percussion into the physical examination revolutionized bedside diagnostics in the eighteenth and nineteenth centuries, and it still holds high value in the detection of common thoracic and abdominal pathology, such as hepatomegaly, splenomegaly, pleural effusion, pneumothorax, and ascites. An understanding of the positioning, pressure, and movements required by the plexor and pleximeter fingers is critical to successful percussion. Similarly, knowledge of the factors that can impact percussion notes is important to enable proper interpretation of findings. Practice with attention to auditory and tactile input helps the clinician develop mastery of the way different percussion notes (tympanic, hyperresonant, resonant, dull, and flat) sound and feel, allowing differentiation of gas-filled, liquid, and solid structures. Percussion remains an important technique that enables clinicians to evaluate deep anatomic structures that are not visible.

## Figures

Figure 1: Children playing drums.

Figure 2: Beer barrel.

Figure 3: Jean-Nicolas Corvisart

Table 1: Characteristics of different percussion notes.

## References

1. Nuland SB. *Doctors: The Biography of Medicine*. Vintage Books, New York, 1988.
2. McGee S. *Evidence-based Physical Diagnosis*, 3<sup>rd</sup> Edition. Elsevier, Philadelphia, 2012.

**Comment [JR3]:** I thought it best to check first, before obtaining these potential photos. If you'd like us to download these images, just let us know:

Figure 1: [http://www.shutterstock.com/pic-185766311/stock-photo-salvador-brazil-october-brazilian-young-people-stand-drumming-in-a-group-in-the.html?src=INqMxCvJEL\\_fKPI8GRCcLg-1-43](http://www.shutterstock.com/pic-185766311/stock-photo-salvador-brazil-october-brazilian-young-people-stand-drumming-in-a-group-in-the.html?src=INqMxCvJEL_fKPI8GRCcLg-1-43)

Figure 2: [http://www.shutterstock.com/pic-126840362/stock-photo-old-oak-barrel-on-a-wooden-table-behind-blurred-dark-background.html?src=7K-j2Nr-YPVqkpDwcBy\\_Cw-1-8](http://www.shutterstock.com/pic-126840362/stock-photo-old-oak-barrel-on-a-wooden-table-behind-blurred-dark-background.html?src=7K-j2Nr-YPVqkpDwcBy_Cw-1-8)

**Comment [AS4]:** I left references in the case you would like to use them in the accompanying manuscript. AS

Percussion note	Pitch	Intensity	Duration	Location (normal)	Pathological example
Tympanitic	High	Loud	Longer	Gastric bubble	Large pneumothorax
Resonant	Low	Loud	Long	Normal lung tissue	Simple chronic bronchitis
Hyperresonant	Lower	Very loud	Longer		COPD, pneumothorax
Dull	Medium	Medium	Medium	Liver	Intra-abdominal tumors and masses, pneumonia
Flat	High	Soft	Short	Thigh	Pleural effusion

