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# Percussion in Cardiovascular Examination of a Tombstone

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***Authors' contributions***

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

The growing abundance of technology in the medical field has led to doctors' sensory de-skilling. Technology is seen replacing the clinical diagnosis based on sensory perception. Percussion as a skill has been lost from clinical practice. Though percussion disappeared from wards, it is still taught in medical colleges. Percussion is a very vital component in the bedside examination of the patient. Auenbrugger first thought of tapping the chest of patients to determine the cardiac size, borders, and presence of pericardial fluid, its extent, and related pathologies. Percussion used to be a critical component of clinical heart disease evaluation. There was rapid advancement of technology in the last century. With the introduction of technology in the medical field, diagnosing and treating disorders and diseases have significantly improved. Percussion can be a valuable bedside aid in determining the cardiac size, borders and to find the presence and extent of pericardial fluid. Cardiac percussion is not just tapping the chest and hearing the sound produced, it is also feeling the touch and observing the vibrations produced noting the tone, thus percussion takes a considerable amount of time, practice and a mindset to master as a clinical skill. Thus teaching the correct way to percuss right from the initial years in the medical school is extremely necessary. With proper knowledge and experience cardiac percussion can prove to be a beneficial tool in specific cardiac pathologies.

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## 1. INTRODUCTION

There was a time when percussion was a very important component in the clinical assessment of heart disease. Percussion has been lost with the introduction of new imaging techniques like X-ray and echocardiography, both of which are more precise in determining the cardiac size, borders and to find the presence and extent of pericardial fluid.

In this rapid world of technology, do cardiologists spend time percussing the chest to detect cardiomegaly and fluid in the pericardium, when they can have a more specific diagnosis with echocardiography in minutes? Honestly they don't. However, with percussion skills, they can get quick information regarding pericardial effusion, pending verification with echocardiography. If used alone, there are chances of error but when used along with other clinical features it proves to be vital bedside tool in differentiating tamponed from acute massive pulmonary embolism until verification from echocardiography.

Should we still practice percussion? Obviously yes. Cardiac percussion is an art and a science and medical students must learn it. Also, practicing cardiologists should use this tool in their clinical practice as it is of vital importance in certain cardiac conditions [1].

## 2. HISTORY OF PERCUSSION

### 2.1 Leopold Auenbrugger, the Native of Austria, was the Inventor of Percussion

Leopold Auenbrugger (1722-1809) invented percussion and René Laennec, known as the father of modern physical examination. The inventor of percussion joined father of modern physical examination. When there was an event of the two-hundredth anniversary of the development of the stethoscope in the year 1816, I proceeded to Austria, Auenbrugger's hometown to further investigate more on material effects. This resulted in clearing out my vision though a bit translucent and also to a bit. Apparently, succeeding generations have not been gratified to this incredible pioneer of clinical science. All the more reason for knowing and protecting what is left of him: buildings, monuments, portraits… Anyway, every time a doctor performs the chest percussion, Leopold Auenbrugger is called to the mind and tribute today, as he was in the past, (that is billions of times each year) [2].

Let's start by recalling the traditional story. Leopold von Auenbrugger was son of owner of an inn, he became experienced observing different sounds of wine and beer barrels in his dad's vault. When he grew up he studied medicine and he used to treat his patients just like beer barrels. As a result the incredible thoracic percussion was discovered. This resulted in his great discovery of thoracic percussion, in which he stated that void patients make the most clamor. His companions shut their eyes to his work and refused his patient and brew vessel correlation. This antique transformation was in twilight until it got saved by Napoleon's physician named Baron Corvisart. He practiced and taught percussion. Because of the huge broadcasting, percussion skills got eternally loaded on medical students [3].

It's not surprising that a musician's psyche led to the development of percussion. Leopold Auenbrugger was a physician who composed some music for the queen of Austria. The music and medicine that met in this man's mind has its roots since he saw his dad tapping on wine barrels to decide its contents.

He studied at Leyden Medical School and graduated in 1752. He was a bright student, and he wrote on the aphorisms of Hippocrates for his thesis. At Spanish Hospital, he worked without receiving any payment and then he got promoted to a higher post that is of an attending physician. He decided to drop off from working in hospitals in 1762. He explained the chest percussion in a text called "Inventum Novum," published in 1761.

He defined different lungs' sounds in different cases, but rather than understanding his approach, he was held accountable for piracy! He was charged that he copied from Hippocrates, since Hippocrates explained the succussion splash, the pleural rub,. But this was not true as Auenbugger pioneered chest percussion in normal and abnormal variants and in physical diagnosis.

He wrote that what he has written, he has verified repeatedly by witnessing through his own senses and surrounded by strenuous, exhausting toilsome exertions, though observing, on each instant, against the alluring impact of confidence." He was fortunate that, Napoleon's

physician, Corvisart, unearthed his work and immortalized it by publishing it. Otherwise his innovation might have been lost in darkness [4].

One fine morning I received an email message from a professor of pulmonary medicine, it expresses that 'percussion note is right in certain conditions and as he would see it is a kind of sound'. I began to pay more attention to percussion, particularly the respiratory examination [5]. However, it wasn't long before other doctors stated that the method was all about touch, not sound. One professor of internal medicine stated, reclining in his office seat, that he could perform percussion even if he was unable to hear or deaf as it is about the sensation of percussion more than the sound itself and he knew it was contradictory to my findings.' Many educators and learners told me that percussion was more about experiencing the vibrations than listening to the music, which was particularly true in loud hospital rooms. Not only was the sound created by touch, but the discoveries were also sensed by touch, via the listening fingers. There was no agreement on whether percussion was about sound or touch, and it didn't appear to issue eventually: phrases like "You are listening now," "You are watching out at this point. Now you are thinking, 'Everything's incorporated!' a professor from Melbourne asserted.

Auenbrugger's instructions are supported by a strong correlation between sound and perception through touch in practice of percussion. The mixed character of the sensory perception of percussion is frequently emphasized in clinical examination texts. The Oxford Handbook of Clinical Medicine, for example, gives the following directions for percussion in a small yellow book placed on top of any decent medical student's heap of ipads, clipboards, and papers:

All locales, including the axillae, clavicles, and supraclavicular regions, ought to be percussioned. Tune in and feel for the sound's inclination and evenness.

The practice of percussion is instructed as a listening or touch strategy, yet as a mix of the two. Other textbooks back this up: Talley and O'Connor write, "The percussion note's vibe and the sound both are equally essential" (1992: 111). In the Essentials of Respiratory Medicine, Cade and Pain (1988) explain that 'percussion brings about a perplexing arrangement of signs giving the analyst both the hear-able data of pitch and the material data of vibration or obstruction, and mirrors the proportion of air to solid structures under the space being percussed.'

## 3. DISCUSSION

Many historical, sociological, and anthropological studies of medical practise treat touching and hearing differently, assuming the faculties as free elements with interrelated tangible organs; the ears hear, the eyes see, the fingers contact, etc. Over time, these tidy divisions have become problematic. For example, David Howes (2003) discusses occurrences of intersense, a word that preserves a sense of sensory separation. Although Aristotle is frequently described as considering the five senses to be distinct, his effort on common sense shows an endeavor to look past the five classifications and explore an intervening sense that helps us feel. Heller-Roazen finishes good judgment later philosophical work, expressing that the conventional issue of the center sense got new earnestness in later advancement, recast as an internal touch, a vibe of one's crucial movements, and one's experience of being alive. This was a sensation that couldn't be readily localised or defined; for some, it was skin, for others viscera, muscles, or blood, and for still others, it was everything at once (Heller-Roazen, 2007: 251) [6].

The essay written by Corvisart has been broken down into six sections. The pericardium, heart muscle, tendinous components, varia and aorta are the five sites of organic change. The final section covers aetiology, diagnosis, prognosis, and therapy options. The discussion on pathological lesions is illustrated by case studies. Corvisart reported clinical entities that reflect the symptoms currently linked with coronary artery disease, but he seems to have been ignorant of, or hesitant to acknowledge, the ideologies on this ailment advanced over the Channel, probably due to his political context. He linked mitral valve stenosis to a perceptible "thrill," or it can be understood like some pulsations can be sensed by the fingertips on the chest [7]. He was especially keen on cardiovascular enlargement, what was labelled as "aneurysm," and classified it into "active" (thickened muscle) and "passive" (non-thickened muscle) categories (thin muscle). Corvisart attempted to identify aneurysm in the clinical environment by placing his hand on the chest of the patient or percussing the area of precordium to evaluate the amount of dullness in tone cardiac. He felt optimistic about his capacities to figure out active from passive aneurysms [8]. After two years, in his

interpretation of Auenbrugger's Inventum novum, he emphasised on the importance of percussion [9]. Corvisart used the face's tinge and presentation, the condition of the pulse, the presence of edema, difficulty in breathing, hepatomegaly, thrill that can be palpated, predictions of lung congestion, pleural effusion, or cardiomegaly as obtained by percussion to define the clinical indications of cardiac illness. There were numerous symptoms, but even Corvisart admitted that it was often difficult to tell the difference between heart and lung problems [10].

Laennec shared Corvisart's primary interest in myocardial volume alterations, but he was not blind to other elements of heart disease. He was able to distinguish between two types of congenital cardiac illness: patent ductus arteriosus and septal defects. He also left A unique depiction of alteration of valves, dubbed "globular excrescences," whose origin is still unknown [11]. He reported his first publication, a clinico-pathological case of a 22-year-old male who had hydrothorax and distention of right ventrical was anticipated by Corvisart, by the help of carcassic percussion immediately before dissection, in 1802, at the age of twenty-one.

Corvisart had also suggested that "organic lesions" might be detected on the left side of the heart, and there was a possibility of discovering principal cause of the disease [12]. The autopsy found ossification of the mitral valve, verifying the accuracy of his prognosis regarding the lung and right-side ventricle.

According to P Rayer, his capacity to give a right analysis dependent on an association between the clinical viewpoint and pathological anatomy frequently dumbfounded his audience members [13]. He was a "pathological anatomy pioneer" who "autopsied every patient dying on his wards." During clinical examinations, Corvisart often placed his hand over his patient's chest. He came up with a piece of very defining information by using this technique: the "murmur" of the heart [14]. After palpation, he also performed percussion, which Auenbrugger had envisioned forty years before [15].

Despite his cautious wording, the last argument of Laennec, that disproved the vegetations' venereal etiology, was persuasive. In 1832, Laennec's observations were confirmed by James Hope [16].

As a result, until 1830, there was no actual creation of a clinical entity. Furthermore, the claim that valves' vegetative involvement was related to syphilis got disparaged. 'Cardiac workings' gets affected by a few bruises, particularly specific indications or "noises," were noticed. Palpitations, respiratory difficulties, swelling of lower limbs, rheumatic pain, cough, pyrexia, tiredness, and dyspnea were all reported correctly, albeit valves' vegetation was not related to them. During autopsy, "vegetations," "concretions," or "outgrowths" on the cardiac valves or its chambers did not produced the diagnosis of a particular illness. As a result, it was often impossible to tell what was there from the start, what arrived subsequently, and even what may have appeared after death in an illness that got increasingly convoluted on the long run. Further developed clinical perception procedures, as well as data gleaned from percussion and auscultation, helped construct manifestations that matched postmortem lesions. The hunt for a way to identify these sores in a living patient began then. In Paris, in particular, a genuine "research spirit" transformed the hospital into a type of laboratory as well as a teaching institution [17].

The aye-aye (Daubentonia madagascariensis), a monkey discovered uniquely on Madagascar's island, is absolutely and unconditionally reliant on percussion to search its supper, that contains creepy crawly hatchlings burrowing underneath tree husk. The creature expands a long, spindly third digit into the tunnel and gathers up its feast in the wake of finding it with percussion [18,19].

Francis Henry Williams contrasted sizes of heart estimated by percussion with results on chest radiography, a novel method at the time, and heart weight recorded in 546 autopsy in 1899. He ruled out cases of emphysema," that puts percussion on loss." He discovered where the cardiac size was close to regular, percussion errors were minimal. Error was particularly common where cardiac dimensions were lower than regular. Percussive errors were less common but larger in size when the heart was enlarged [20,21].

## 4. CARDIAC PERCUSSION TECHNIQUE RELIABILITY VS. CARDIOTHORACIC RATIO AND TRANSTHORACIC ECHOCARDIOGRAPHY IN DETERMINING LEFT VENTRICULAR SIZE

Cardiac percussion (CP) is a bedside method for determining the cardiac boundaries, chamber

size, and pericardial fluid extent. Despite the fact that new cardiac imaging tools have changed the procedures for detecting enlarged heart, CP as a skill is chosen most often, particularly in emergency cases. Notwithstanding the way that transthoracic echocardiography (TTE) is acknowledged more precisely for deciding the left ventricle's size, Cardiac percussion can appraise size of the left ventricle with equivalent precision in a proper clinical setting. We will likely research the relationship of left ventricular size utilizing the Cardiac percussion method and contrast it with standard transthoracic echocardiography and the cardiothoracic proportion (CTR) on chest roentgenography [18,20,22,23].

There was a research conducted to find out the correlation between the findings of Cardiac Percussion, which we get easily bedside and the results of transthoracic echocardiography and reference from roentgenography. The Telemetry unit of BronxCare Health System was the subject of this descriptive research. The sick person was kept at a Gatch angle of 30 to 45 degrees as part of the physical examination in this bedside method. Along midpoint of clavicle is percussed to the gladiolus of the sternum was used to measure cardiac dullness. The size of left ventricle (in centimetres) and the point of reference were then measured using a ruler (middle left parasternal border). Following that, we linked findings with transthoracic echocardiography dimensions of left ventricular end-diastolic diameter (LVEDD) during the same hospitalization. We also used chest roentgenography to measure the CTR (CXR). The clinical history and imaging findings were hidden from the percussors. The left ventricular (LV) volumes were calculated using the Teicholz technique. The variability in each estimate was estimated using the coefficient of variation (COV). Pitman's test was utilized to investigate the distinction in change between any pair of measurements, and Bland-Altman plots were created to look at any estimations [23-29].

As the above procedure was carried out the following results were obtained. 200 patients were on average 63(15.81) years old, with female accounting for 51 percent of the total. The average BMI was 28.5 KG/M2, and 33% had a normal BMI. A total of 22% of the participants were found to have a diagnosis of heart failure. The left ventricular diameter evaluated with the Cardiac percussion technique was analogous to the left ventricular end-diastolic diameter obtained using transthoracic echocardiography (Mean 4.65cm 0.67 vs 4.69cm 0.76, COV 7.6%). The left ventricular end-diastolic diameter was shown to have no association with the LV diameter measured by CXR (5.79cm1.21, COV 14.3%, r=-0.475, p0.001). The left ventricular volumes determined using the Cardiac Percussion method were found to be in agreement with the left ventricular volumes assessed using transthoracic echocardiography. (14.9 percent coefficient of variation).

## 5. CONCLUSION

The CP technique is a simple bedside approach for determining the size and volume of the left ventricle. It has been found to have a strong relationship with LVEDD as assessed by TTE. In the estimate of LV size, CXR was shown to have no connection. The research underlines the need of utilising a physical examination approach to estimate LV size at the bedside. Our findings will need to be confirmed in future investigations.

The developing plenitude of innovation in clinical field has prompted specialists' tangible de-skilling. Innovation is seen supplanting the clinical determination dependent on tactile insight. Percussion as an expertise has lost from clinical practice. Percussion is an extremely essential part in bedside assessment of the patient. It was Auenbrugger who initially considered tapping the chest of patients to decide the heart size, boundaries, and presence of pericardial liquid, its degree and related pathologies. Percussion used to be a basic part of clinical coronary illness assessment. There was quick progression of innovation in last century and with the presentation of innovation in clinical field, the analysis and treatment of problems and infections have improved by and large. Percussion can be a significant bedside help in deciding the cardiovascular size, borders, and track down the presence and degree of pericardial liquid. There is plausible of misconception whenever utilized alone. Yet, when joined with other clinical attributes, it has all the earmarks of being it ends up being an amazing bedside practice in recognizing tamponed from acute massive pulmonary embolism until echocardiography affirms the determination.

Hence, this concludes that cardiac percussion should be learned by medical students and cardiac percussion should be used by practicing cardiologists and they should utilize this tool in

their clinical practice as it proves to be of vital significance in specific heart conditions.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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