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Gac Med Mex. 2015;151:244-8

Auscultation of the heart: an art on the road to extinction

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Abstract

Auscultation of the heart is a clinical art that allows the doctor to make accurate diagnoses with the skills after formal training. The technology efficiently complements the clinical diagnosis, so that the latter is insufficient without a clinical approach; on the other hand, when the clinical practice is replaced by technology, diagnosis and treatment is equally ineffective. The cult of technology has led to the gradual loss of the ability of cardiac auscultation, and the doctor has lost a powerful tool with diagnostic potential. (Gac Med Mex. 2015;151:244-8)

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KEY WORDS: *Cardiac auscultation. Physical examination. Medical technology.*

Skillfully performed cardiac auscultation is really an art (art: virtue, ability or skill to conduct an activity[1]), which flourished in the 19th Century in France (Laenec, Potain, Corvisart, Laubry, etc.)[2] and was inherited by English (Leatham[3], Sutton[4], Stokes[5], Steell[7], Still[7], P. Wood[8], etc.), North American (Latham[9], Osler[10], Harvey[11], Fowler[12], Perloff[13], Humphries[14], McKisick[15], etc), Argentinian (Luisada[16]) and, specially, by Mexican cardiology with Manuel Carpio (1791-1860), who translated from French the "Pectoriloquy Book" (1819), by Claude Marat, and his disciple Miguel Francisco Jiménez. Fascinated by the publications of French cilinicians, both mastered, practiced and diffused cardiac auscultation and so, in the city of Puebla, they founded Mexican clinical cardiology[17]. However, the most important influence in Mexico was initiated by Dr. Ignacio Chávez after receiving the teachings of Vaquez and Laubry[18] in France, followed by Rivero Carvallo and Rafael Carral, who, through their teaching activities in the National Institute of Cardiology, spread it throughout the country. From the middle of the 19th Century to the second decade of the 20th Century, the art of auscultation flourished in different latitudes of the world, which considerably enriched clinical diagnosis in cardiology. The physician became able either to recognize countless heart diseases at the patient's bedside, or to disregard a diagnosis of heart disease when the presence of "innocent" or inorganic murmurs was identified[7,14].

The richness of data offered by clinical examination of the heart and especially by auscultation enabled physicians to perform diagnoses that were sometimes complex with a simple physical examination.

In 1894, Wilhelm Einthoven performed the first phonocardiographic recording in the world[19]. The development of this method was due to Otto Frank in Munich, Carl J. Wiggers in Cleveland and I. Ories and Braun Menéndez in Argentina. This type of study, which was named *phonocardiogram*[15], was perfected by Paul Wood in the decade of 1950 and by Leastham[20] in the National Heart Hospital of London.

The advent of phonomechanocardiography in Mexico in the decade of 1950 allowed for clinical signs from

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Date of reception: 09-12-2013
Date of acceptance: 27-03-2014

both inspection (jugular and hepatic pulse record) and palpation (record of the morphology produced by the apex beat, of the right precordiogram, of the pulmonary impulse when there is lesser circuit hypertension, etc.), as well as from cardiac auscultation (record of normal cardiac sounds, splitting of the second heart sound, valvular opening snaps and, of course, cardiac murmurs) to be made objective. With this, not only clinical diagnosis became objective[21], but this method allowed like no other for the teaching of clinical examination of the heart and especially of auscultation to be enriched.

This way, in the National Institute of Cardiology "Ignacio Chávez", the teaching of physical exploration of the heart flourished from the decade of 1950 on. All cardiology residents, including myself, received tutorial teaching at the patient's bedside directly from great teachers: Ignacio Chávez, Manuel Rivero Carvallo, Salvador Aceves, Rafael Carral, Felipe Mendoza, Bernardo Fishleder, Jorge Espino Vela, Luis Adolfo Mata, Jorge Soberón, Leopoldo Rebollar and the youngest of that generation, such as Jorge Kuri and Carlos Zamora. This teaching is complemented with graphic records that enable visualizing what the physician palpates and auscultates (Fig. 1). Phonomechanocardiography (a term coined by Dr. Bernardo Fishleder) flourished in Mexico and Latin America and spread to Europe thanks to the mastery of Fishleder himself[21], who cultivated, taught and promoted it for more than 30 years. Fleshleder created a broad treatise on phonocardiography, adding and emphasizing the simultaneous record of precordial movements, arterial and venous pulses, and clinical and pharmacological maneuvres, thus introducing the study of ventricular function, as well as valvular and congenital lesions quantification, and this is the reason he named his treatise *Cardiovascular examination and clinical phonomechanocardiography*. Unfortunately, in the decade of 1990, with the appearance of clinical echocardiogram in 1965[22], the devices for the recording of the phonomechanocardiogram went gradually dissappearing, since the new study broadly surpassed the information obtained with the graphic record of physical examination. Indeed, echocardiogram offers the clinician the possibility to directly calculate transvalvular gradients and regurgitant volumes, it visualizes heart congenital defects and also enables the measurement of cardiac cavities dimensions, thickness of their walls, valvular areas and several more complex parameters of the ventricular function, such as the degree and type of hypertrophy, systolic and diastolic function of the heart, pre- and post-charge, etc.[23], which is why it clearly

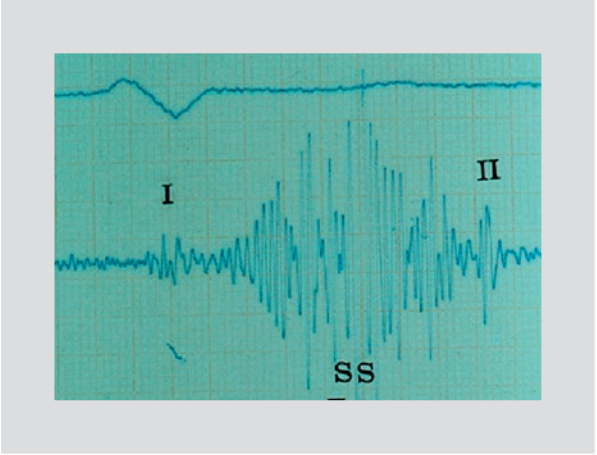

Figure 1. *AS. The record demonstrates that between the first (I) and the second (II) sound there is a "diamond-shaped" SM; note that highest intensity of the murmir is far away from the first sound: it denotes seriousness. The record allows for the physician to see what he/she hears. SM: systolic murmur.*

surpasses phonomechanocardiography to obtain this information (with the latter procedure, these data are also obtained, but indirectly). However, clinicians overlooked that the dissapearance of the phonomechanocardiographic record would also imply losing the best way to objectively learn the physical examination of the cardiovascular system; with this regard, it should be noted that heart sounds and murmurs have never been able to be reliably reproduced with simulators and, therefore, currently, the only way to receive this training is by means of physical examination at the patient's bedside, which is performed by the cardiology resident under the direct guidance of an expert cardiologist who transmits the way to recognize, by means of inspection, palpation, percussion and auscultation, cardiovascular diseases through history taking and physical examination. This learning process has to be carried out in institutions with high concentrations of patients with a variety of cardiovascular conditions.

The required process to learn cardiac auscultation can be compared with that required to learn how to play a musical instrument. Cardiac auscultation takes between two or three years for the clinician to acquire enough skills that allow for him to recognize, by this clinical method and with accuracy, the diagnosis of different cardiovascular diseases. For example, initially, the cardiac cycle has to be known and understood; then, a mental picture of it has to be made. When the physician has it clear, he/she places the stethoscope on the patient's chest, and identifies the first and second heart sounds, translating the acoustic reception to the frontal lobe, this way locating the systole and the diastole

(between I and II the latter, and between II and I the former); when the brain identifies and recognizes these phenomena. The physician also has to know the physiopathology of cardiovascular diseases and, again, make a mental image of these phenomena. Let's take aortic stenosis (AS) as an example: the aortic valve opens at systole, and when it narrows, a turbulent blood flow is generated, which translates into a "harsh" murmur (Fig. 1); since the aortic valve is projected towards the thorax at the level of the second right intercostal space, there is where the murmur is heard more intensely and, since the turbulent flow travels from the ventricle towards the ascending aorta and carotid vessels, the murmur has precisely this irradiation. When the physician hears an AS, he/she must have the mental image of the entire process. Cardiac auscultation also allows for differential diagnosis of rapid arrhythmias to be accurately made. Normal electrical activation sequence of the heart makes for the auricle to always contract before the ventricle; this way, in a 200-beat per minute tachycardia, auscultation will reveal that the first sound has always the same intensity and, this way, the physician will be sure that the atrioventricular sequence is normal (supraventricular tachycardia)[23]. On the other hand, when auscultating a patient with tachycardia of the same frequency, recognizing that the first sound is variable in intensity from beat to beat informs the physician that the atrioventricular sequence has been lost, and that there is presence of ventricular tachycardia[23]. These examples demonstrate that the basis of cardiac auscultation is the mental image of that what is heard, how physiology and pathophysiology of heart diseases are represented in the mind of the trained physician. In other words, the diagnosis is established when the cardiologist depicts in his/her mind what is happening inside the patient's heart through auscultation, the same way Beethoven, being completely deaf, heard in his mind the musical notes and, by displaying his genius, was able to write the part of each instrument and all voices that made up the choral part that gave life to Schiller's poem *Ode to joy* on the pentagram (Fig. 2) of his portentous *Ninth Symphony*[24].

As we can see, this process is complex and requires time, knowledge and dedication to acquire cardiac auscultation clinical skills.

Since the decade of 1990, the great cardiology teachers[25] have witnessed with great concern a gradual decrease in the capability of physicians to recognize heart diseases by means of heart auscultation (Fig. 3). The poor capacity of physician trainees to auscultate the heart has been demonstrated and, for this reason, experts have recommended increasing the time spent on teaching in this sense[26].

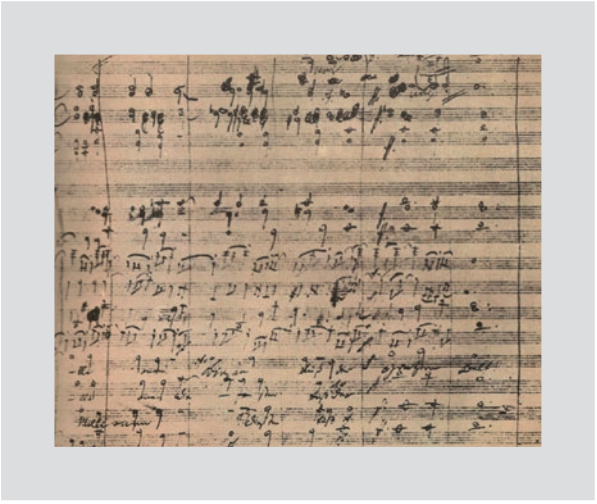

Figure 2. *Fragment of the pentagram with the last movement of Beethoven's Ninth Symphony; original manuscript* (adapted from Orlando[24]).

The modern physician, instead of gradually including the consistent knowledge of new technology to his/her comprehensive clinical training, in order to complement diagnosis and therapeutics[27], has made a simplification of knowledge to an unacceptable level, to an extent that gradually he/she is forgetting about physiology and pathology, which are substituted by algorithms that irrationally dictate the diagnostic and therapeutic behavior, following clinical practice quidelines and forgetting about clinical features, physical examination and pathophysiology, thereby losing the highest quality the physician must have: **CLINICAL JUDGEMENT,** and this often results in inaccurate diagnoses, wrong treatments and an unnecessary increase in medical costs[28]. This phenomenon has produced stagnation in clinical cardiologists, in what Donato[29] has referred to as "stunned cardiologists".

Currently, with the advance of technology, heart auscultation has gradually, almost imperceptibly, been abandoned. It is not common for a cardiology specialist to address cardiac auscultation as a procedure that will help to design the diagnostic workup and to make therapeutic decisions for his/her patients. Usually, if a cardiac murmur is detected by auscultation, without further physical assesment, the patient is sent to have an echocardiogram performed to establish the diagnosis and the magnitude of the problem. In our current reality, echocardiographic testing also happens to be complex and requires special training at least for a year, although ideally for two, in order to master the method. Echocardiogram has a disadvantage because, since the operator

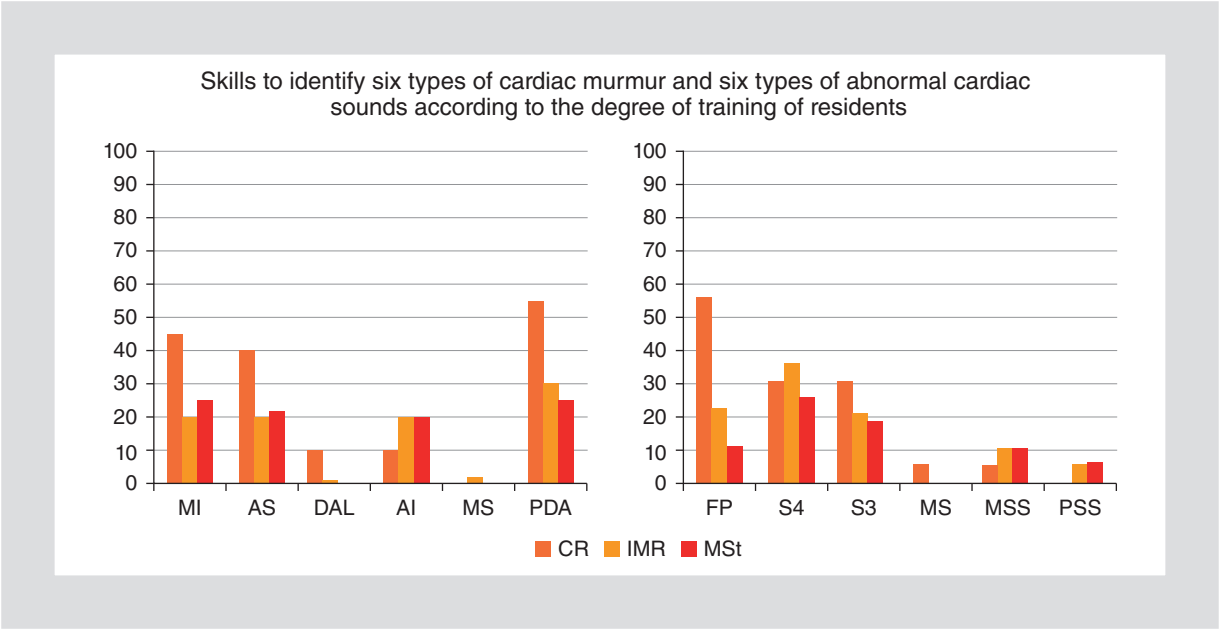

Figure 3. *The skills to auscultate murmurs and abnormal sounds of the heart were assessed in MSt, IMR and CR. This figure shows the lack of skills for cardiac auscultation in the three studied groups. Those who theoretically are highly trained, CR, hardly reach 50% of the skills to recognize abnormal heart phenomena. CR: cardiology residents; IMR: internal medicine residents; MSt: medicine students; MI: mitral insufficiency; DAL: double aortic lesion; AI: aortic insufficiency; MS: mitral snap; PDA: patent ductus arteriosus; PF: pericardial friction; S4: fourth sound; S3: third sound; MSS: mesosystolic snap; PSS: protosystolic snap;* (adapted from Mangione et al.[26]).

is able to obtain echocardiographic images relatively easily, and specially colored images that impress both the clinician and those who review the study. Thus, the usual is that without having a complete training, images most of the times obtained with a defficient technique, are used to make calculations that obtained this way are inaccurate and, therefore, diagnoses are established that are frequently wrong. In our real world, it happens that a cardiologist listens to a cardiac murmur that he/she is not able to interpret and orders an echocardiographic study, which frequently is performed by another physician who is not fully skilled on the study technique and obtains an inaccurate final result, which ends up in a therapeutic decision that is not precisely one that will benefit the patient. This way, the physician with a lack of clinical training, is dragged by a wrong interpretation of a defficient study and, in spite of being in the 21st century, diagnosis and treatment are paradoxically carried out less accurately than 30 years ago. This behavior has led to a paradox: the more technology there is, the less professional capacity physicians have.

In our country, the most important contributions to clinical cardiology have been made by Professor Ignacio Chavez[30] through his school, his face-to-face teachings, conferences, writings, and the large impact he had on Mexican medicine. He claims that the modern physician must base his/her practice on high-level clinical medicine (the cardiologist must be an expert on heart auscultation) and now requires larger effort to be trained and to understand the new technology[27], in order to use and iterpret it adequately, in such a way that it really serves to obtain information that cannot be attained with the medical record documented by an expert. The more complex high technology becomes, the more necessary the skills the physician requires to understand and interpret it[27]; combining both types of knowledge, more effective diagnosis will be able to be established, which will lead to more appropriate therapeutic decision-making.

The adequately and comprehensively trained physician must recognize the cardiovascular system status in a high percentage of patients by means of a well documented medical record (with special emphasis on cardiac auscultation)[23], properly using currently available new modern diagnostic methods that, rationally selected according to the patient's condition, must be interpreted and judged by the treating physician him/herself in order to analyze if the study is technically satisfactory and if its interpretation is well supported, if it confirms or disregards the diagnosis or rather if, on the contrary, the study reveals another unsuspected diagnosis. If there is disagreement between clinical features and study results, the cause must be searched and, if it's not found, furher investigation has to be made using a different diagnostic method, including

CT angiography, magnetic resonance and cardiac catheterization. In other words, diagnosis and therapeutic decision for each patient must be governed by clinical judgement, which results from the physician's solid professional training, along with his/her own experience, and both must be confronted against evidence-based medicine in order to make final decisions.

So, since currently there are increasingly less cardiologists who are experts on heart auscultation, there are also few hospitals harboring a concentration of patients with a variety of cardiovascular conditions. The physician trainee diverts his/her attention and is dazzled by currently available marvelous technology and tries to become skilled on the techniques to operate these new devices, but not to learn how to examine the patient[27], let alone to master cardiac auscultation, due to the time and effort required to become skilled in this clinical maneuver. Under these conditions, if the way medicine is currently practiced is not changed, ***cardiac auscultation clinical art will continue to be gradually lost, until it becomes a mere historical fact.*** This sad perspective for medicine should be stopped, and resuming the path of consistent clinical teaching would be necessary (in the cardiology specialty, more emphasis on heart auscultation must be placed), based on the knowledge of disease pathophysiology; this will allow for modern diagnostic methods to be used with a precise indication, knowing what we are looking for and analyzing the study to be able to exactly discriminate which information is useful for the patient and which is uncertain or divergent, in order to informedly investigate the reasons for divergence, thus clarifying the actual status of the patient and being able to make a decision. In other words, modern methods should help us and not confuse diagnosis when "routinely" used without knowing the utility they offer and the limitations they have, especially those methods that are "operator-dependent".

In conclusion, the path of consistent clinical teaching of medicine has to be resumed, supported by pathophysiology of diseases, in order to improve patient medical care, and modern methods should be used rationally rather than "routinely" and, finally, an appropriate interpretation of evidence-based medicine should be used as support. All this, aiming to achieve personalized care for each patient, as well as clearly more effective care for the treatment and prevention of human disease. ***Only this way we will be able to say that we really practice modern medicine***, where human and technological resources are put together to aid the patient and not substituted between each other and thus wasting the ommited resource.

Epilogue

"Medicine as scientific knowledge has always demanded from the physician a fine observation spirit and straight judgement on data interpretation. Logical reasoning has been its best support to establish a diagnosis; for that purpose, cultivation of intelligence is the basis, and the brain, its best instrument"[27].

Ignacio Chávez

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