УДК 616.1-07

ПЕРКУССИЯ ПРИ СЕРДЕЧНО-СОСУДИСТЫХ ЗАБОЛЕВАНИЯХ

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Резюме. Данная публикация посвящена вопросам патофизиологической интерпретации краеугольных вопросов пропедевтики внутренних болезней, в первую очередь — на материале сердечно-сосудистой, эндокринной и бронхолёгочной патологии. Пропедевтика толкуется авторами широко: как введение во внутреннюю медицину, поэтому лекции содержат и терапевтический, и клинико-патофизиологический материалы. Лекция сопоставляет достижения и традиции отечественной терапевтической школы с принципами преподавания внутренней медицины, сложившимися в практике зарубежного медицинского образования. В пятой части рассматриваются история, виды и методология контактного обследования и интерпретации его данных применительно к перкуссии при сердечно-сосудистой патологии (5 рис., библ.: — 14 ист.).

Ключевые слова: гипертрофия миокарда; границы сердца; дилатация сердца; история медицины; перкуссия; плессиметр; порок сердца; сердечная тупость; сердечно-сосудистые заболевания; сосудистый пучок; физикальное обследование.

PERCUSSION IN CARDIOVASCULAR DISEASES

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Abstract. This publication is an example of pathophysiologic interpretation of crucial aspects of Propaedeutics of Internal Diseases, primarily based on the material of cardiovascular, endocrine and bronchopulmonary diseases. Propaedeutics is widely interpreted by authors as an Introduction to Internal Medicine; therefore, these lectures also contain clinical pathophysiologic material. The lectures compare the achievements and traditions of Russian classical therapeutic school with the principles of Internal Medicine that have evolved in the practice of foreign medical education. The fifth lecture is dedicated to history, types and methodology of physical touching examination and its data interpretation related to percussion in cardiovascular pathology (5 figs, bibliography — 14 refs).

Keywords: Cardiac Dullness; Heart borders; Cardiovascular Diseases; Heart Dilatation; Heart Valve Disease; Hypertrophy of Myocardium; History of Medicine; Percussion; Physical Examination; Pleximeter; Vascular Bundle.

INTRODUCTION

Before XIX age physicians just interviewed their patients, then visually examined them and palpated their bodies; however that was not enough to judge upon the presence or absence of pathologic changes in inner organs, especially those located behind the stiff carcass of thoracic cavity.

The whole modern concept of medical physical diagnosis and the very principle of body location for the foci of internal diseases in vivo — are based on a genius discovery of late XVIII century made by an Austrian physician Josef Leopold von Auenbrugger (19 November 1722, Graz, Duchy of Stiria — 17 May 1809, Vienna, Austrian Empire). He published in the last days of

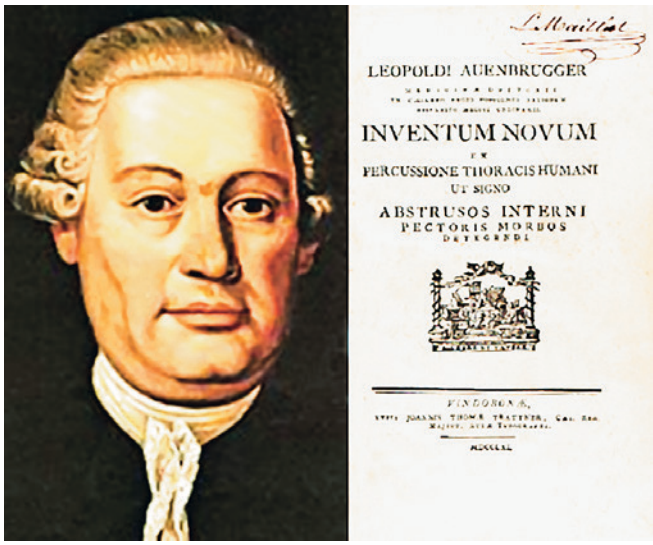

Fig. 1. J. L. von Auenbrugger and title page of his pioneering book in percussion

Fig. 2. F. K. Uhden, pioneer of percussion in Russia General Methodology of Percussion

1760 a small but revolutionary medical book "*New Invention by Means of Percussing the Human Thorax for Detecting Signs of Obscure Disease of the Interior of the Chest",* where on 95 pages described in details an absolutely new method of objective physical examination [1]. Soon the book was translated into French for the first time (1770).

There is a legend, that doctor Auenbrugger (fig. 1) was inspired by his childhood experience, being a son of an innkeeper who tested by percussion a content of wine casks at his family hotel. He wrote: *"…I here present the reader with a new sign which I have discovered for detecting diseases of the chest. This consists in percussion of the human thorax, whereby, according to the character of the particular sounds thence elicited, an opinion is formed of the internal state of that cavity. In making public my discoveries respecting this matter, I have been actuated neither by an itch for writing, nor a fondness for speculation, but by the desire of submitting to my brethren the fruits of seven years' observation and reflection"* [1, 14]. Doctor Auenbrugger was not only a medical practitioner, but also a real early clinical pathophysiologist, because he experimented with cadavers filling up their cavities with fluids and testing the changes of percussion sounds in an attempt to know precise correlations between sound and structural changes. As many medical innovations, his book faced very cold attitude and even negativism of the contemporary practitioners, who hated to learn again and preferred to stay in comfort within old limits of their corporative professionalism. But, the method of percussion was later (1806–1808) broadly popularized by leading French physician of Napoleon's epoch Jean Nicolas Corvisart (1755–1821), who translated anew, added, commented and published Auerbrugger's book in France [4]. The coryphaeus recommended the method to all disciples of his huge medical school, and the method has been spread through the world widely. For that era the manual and later on — instrumental percussion brought in Medicine changes similar to those later elicited by X-ray technic, or much later — by ultrasonography. The first medical doctor in Russia, who systematically studied, performed and taught method of percussion [12] was a Professor of Pathology and Medicine at Medical-Surgical Academy of Saint Petersburg Feodor (Friedrich) Karlovich Uhden (1754–1823) (рис. 2).

Percussion is based on production of mechanical sound waves by gentle tapping of a part of one's body, which waves are reflected from inner structures and absorbed by tissues and fluids, finally reaching the doctor's ears. The method is applied in Cardiology in order to determine heart's size, configuration, position and big vessels' dimensions [2, 6, 7, 9, 13].

It is convenient to perform percussion while the patient is standing straight, but in serious state of a patient his/her heart may be percussed in lying position [2, 13].

Heart borders usually are a little bit broader, when person is lying in bed.

Percussion may be either instrumental (mediated through special device — a pleximeter (fig. 3) or indirect — with a plexor finger via finger-pleximeter, or sometimes with a hammer plexor across pleximeter device) or direct (immediate or palpatory one) — by tapping the skin with the doctor's finger (s) — plexor (s).

There are six laws of medical percussion, mandatory to follow in order to establish reliable data:

- Finger-pleximeter should be tightly attached to the chast wall;

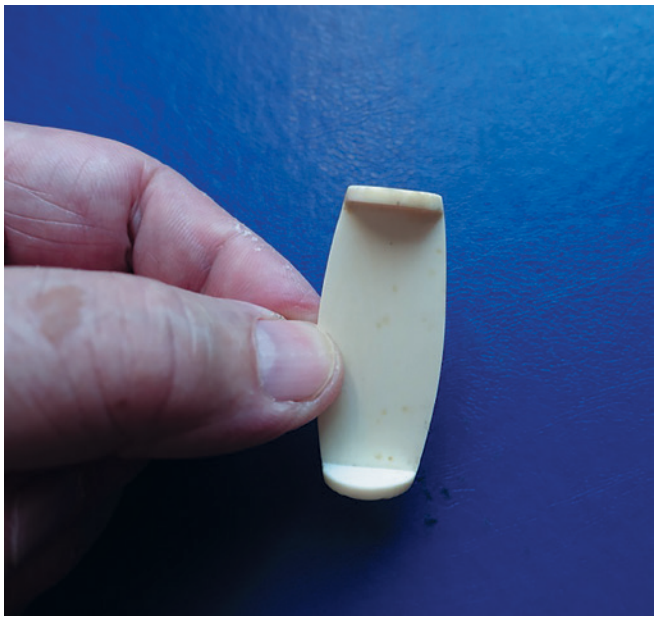

Fig. 3. An old medical pleximeter made of walrus tusk. An instrument belonged to famous Russian physician, Nikolay Yakovlevich Chistovich (14 December 1860, Saint Petersburg — 26 March 1926, Leningrad), personal internist of Romanov royal family (from private collection of Y. I. Stroev; gifted by granddaughter of Prof. N, Ya. Chistovich — Dr. N. G. Chistovich-Dobrovol'skaya)

- Finger-pleximeter always should be situated in parallels with the border of an organ which doctor has to check;
- Checking relative cardiac dullness, a doctor should percuss by finger-plexor strikes of moderate strength;
- Checking superficial (absolute) cardiac dullness (over the pericardium or portion of heart, non-covered by the lungs and directly attached to the thoracic wall), a physician has to use smoothest and lightest percussion (threshold percussion by Goldscheider[1], percussion along intercostals spaces — by Plesch[2]) [8].
- The courses of percussion always go from clear sound to dull one (in cardiologic practice — from the lungs to the heart).
- The organ border by percussion is taken along the external side of the pleximeter finger.

The sound of percussion can be resonant, hyper-resonant, stony dull or dull [12]. A dull sound is heard in presence of a solid mass under the place of tapping. A hyper- resonant (e. g. tympanic) sound indicates hollow, air-containing structures. Mechanical waves also produce different sensations in the pleximeter finger, which makes percussion closer correlating to palpation method and its data.

The sequence of percussion steps should always be the following:

- Checking of right cardiac dullness border;
- Checking of left cardiac dullness border;
- Checking of upper cardiac dullness border.

CARDIAC DULLNESS BORDERS

Relative cardiac dullness is determined before absolute (superficial) one.

At first doctor has to determine the upper right diaphragmatic dome border, then rise pleximeter finger one intercostal space up and percuss the right cardiac border until the transition of clear resonant sound into dullish one.

Normal right cardiac border in healthy individuals is revealed 1 to 1,5 cm to the right from right margin of sternum. It is formed by right cardiac atrium.

Left border of relative cardiac dullness is examined after the determination of apex beat (AB) [11].

Usually, AB is placed on the left relative dullness border.

If AB is not palpable, pleximeter finger should be placed into fifth intercostal space, and percussion goes in parallels with the expected left superficial cardiac dullness border, starting from medial axillary line.

As a rule, in health relative cardiac dullness border is located 1–2 cm to the medium from medioclavicular line and formed by left cardiac ventricle.

To determine upper relative cardiac dullness border, it is necessary to place pleximeter finger near left edge of sternum bone in parallels with the ribs, and percuss beginning from first intercostal space downwards.

Normally, the left border of relative cardiac dullness is situated on upper margin of third rib and formed by left cardiac auricle and by cone of pulmonary artery.

Examining right cardiac dullness border in different points, along different intercostals spaces, a doctor may obtain the outline of heart configuration.

It is changeable, depending on cardiac disorders. In mitral valve diseases all cameras of the heart are dilated, producing typical «mitral» heart configuration [2, 9, 14].

In aortic valve diseases configuration is «aortic» (resembling the profile of sitting duck (fig. 4) or a high boot) [10].

In exsudative pericarditis heart contour has trapezium shape, narrowing up towards the vascular bundle.

After the examination of relative cardiac dullness border, according the same order, the superficial cardiac dullness borders are determined.

Right superficial cardiac dullness border normally goes along left sternal edge. The left one goes along left relative cardiac dullness border or is positioned 1 cm to the medium from it.

Upper normal superficial cardiac dullness border is positioned under the cartilage of forth rib.

[1] Goldscheider, Johannes Karl August Eugen Alfred — a German physician, neurologist and internist (4 August 1858, Sommerfeld, Kingdom of Prussia — 10 April 1935, Berlin, Germany).

[2] Plesch, János Oscar (18 November 1878, Budapest, Austro-Hungarian Empire — 28 February 1957, Beverly Hills, USA) — a Hungarian (later lived in Germany and since 1930ies — in Great Britain and USA) physician and clinical pathophysiologist, close friend and personal medical doctor of Albert Einstein [6].

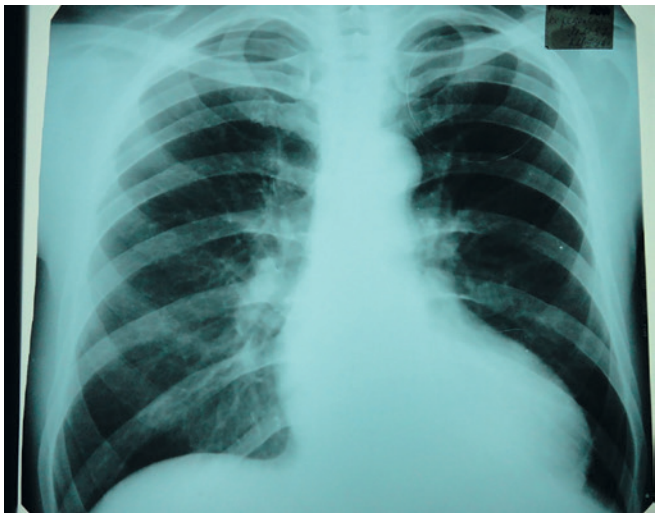

Fig. 4. Typical heart X-ray shadow in aortic valve disease (observation by Y. I. Stroev)

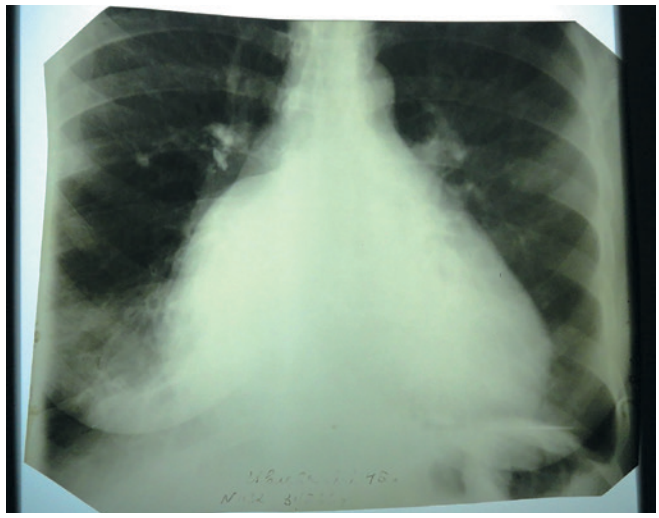

Fig. 5. Typical heart X-ray shadow in cor bovinum (observation by Y. I. Stroev)

Percussion size of the vascular bundle is measured in second space from both sides. As it can be quite difficult, it is advisable to use subtle (gentle) percussion. Normal bundle width is about 5–6 cm. In aortic diseases it is broadened very significantly. Do not confuse expanded bundle with enlarged mediastinal lymph nodes, observed in pulmonary tuberculosis.

Both superficial and relative borders of cardiac dullness may vary depending on phrenic muscle position, on individual somatotypes, or in presence of some cardiopulmonary diseases.

In pulmonary emphysema the borders are squeezed, as well as in people of ectomorph somatotype, which is known ubder several figurative or traditional ancient terms: suspended, hanging or drop heart, cor pendulum (in Latin), or cardioptosis (in Greek).

Relative cardiac dullness border is expanded in people of endomorph somatotype, in cases of ascites, pregnancy or flatulence, but first of all it is typical for cardiac dilatation and (to much smaller degree) — also due to myocardium hypertrophy itself.

Right relative cardiac dullness border is broadened in dilatation of right atrium or/and ventricle (which is observed in tricuspid disease, in pulmonary artery stenosis resulted of Ayerza's disease [11], or in congenital malformations of the heart). It may be broadened in cor pulmonale as well.

Left relative cardiac dullness border is dilated in left ventricle dilatation and hypertrophy (both are observed in mitral insufficiency and aortal valve diseases, in arterial hypertension, or in left ventricular aneurysm). It is accompanied by palpable pathologic precardial pulsation of peculiar pattern in cardiac area (see previous lecture in [11]).

In advanced valve heart diseases, specifically, in tricuspid ones, there is total expansion of heart borders in all directions, which is known as "cor bovinum" (Latin) or bull's heart [3].

Cor bovinum (fig. 5) sometimes is observed in advanced diffuse cardiosclerosis and dilated cardiomyopathy, usually on background of severe heart failure, in a patient suffering from marked breathlessness.

Relative cardiac dullness border is displaced upwards in mitral stenosis due to dilatation of left atrium («parasternal dullness symptom», when not only dullness border is expanded, but also cardiac waist thickened, or even protruded).

Superficial cardiac dullness border is expanded totally in effusive pericarditis, in hydropericardium and also in hemopericardium, usually together with relative cardiac dullness border dilatation.

Superficial cardiac dullness border area is increased in mediastinal tumors, if pulmonary margins squeeze, and also in position of bending ahead. It is, vice versa, decreased on deep inspiration, in emphysema (both pulmonary and subcutaneous paracardial one), as well as in in pneumothorax, or in pneumopericardium. Paracardial subcutaneous emphysema may occur as a iatrogenic complication of unsuccessful left subclavicular artery catheterization, if a lung was occasionally injured. More detailed recommendations on medical percussion can be read elsewhere during your homework [5, 11, 12, 15]. The next phase of physical examination is auscultation.

ACKNOWLEDGEMENT

Authors are grateful to their American students for whom this project was primarily intended, especially to Dr. S. G. Huneycutt M. D., F. A. A. F. P., D. C. and to untimely deceased Dr. William G. Scoggins M. D., B. A., D. C. (1948–2010) for their valuable help in preparation of these lectures. No conflict of interest to declare. Both authors have contributed to the text equally.

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