

HISTORY OF THE STETHOSCOPE AN OVERVIEW

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ABSTRACT

The stethoscope represents the physician perhaps more than any other symbol, except the shaft of Aesculapius of Kos Island, Greece (birthplace of Hippocrates) – the god of Temple medicine of the Greek antiquity. In early modern era of the 19th century, it was a spectacular product of developing synthetic chemical technology which was progressively used in its making. It was a remarkable addition to the clinico-diagnostic armamentarium of doctors. Laennec paved the way in 1819, and since then it has been a long march of continuous innovative development supplying for the demand of relevant auscultatory bedside tool to examine different medical conditions.

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Introduction

The stethoscope could be considered as the symbol of medical and paramedical profession, consisting of doctors and nurses. The word “stethoscope” originates from the Greek words “stetho” meaning “chest” and “scopein” meaning to view or observe. The mechanism of action of the stethoscope at all times – modern and past was and is based on the basic principle of listening to sounds in different body cavities by putting the ear over the relevant site or by means of transmitting sound through a receptacle and tube.

Ebers Papyrus (1500 BCE – Before Common Era – Before the birth of Christ – used specially by non-Christians) and the Vedas of Ancient India around 1400 BCE are thought to have the earliest recorded reference to breath sounds (sound inside our breathing organ – the lungs). Caelius Aurelinus (500 BCE), polymath Leonardo da Vinci (1452 – 1519), Ambroise Pare (1510-1590) – father of modern surgery – Paduan pathologist – Giovanni Battista Morgagni (1682- 1771), Gerard van Swieten (1700 – 1772), founder of old Vienna School, comparative anatomist and surgeon – John Hunter (1728 – 1783) and others all have notations in their writings suggesting some awareness of auscultation as a clinical tool for examining patients.

Hippocrates (460 – 370 B.C.), Father of Rational Medicine, noted the importance of body cavity sound in his “DE MORBIS”.

“You shall know by this that the chest contains water and not pus, if in applying the ear during a certain time on the side you perceive a noise like that of boiling vinegar.”

Hippocrates compared pleuritic friction rub to the creak of a leather belt. Succussion splash is a splashing sound produced when a patient is shaken or moves suddenly, indicative of fluid and air in a body cavity. The splash heard when gas and fluid (usually pus) are present in the pleural cavity is traditionally termed as “Hippocratic succussion”. William Harvey (1578 – 1657), discoverer of the circulation of blood, refers to sounds from the body in several writings.

“Even for it comes to pass, that while some portion of blood is drawn out of the veins into the arteries, there is a beating which is heard within the breast.”

Cardiologist, Baron Jean-Nichols Corvisart (1755 – 1821), physician to Napoleon Bonaparte, was accustomed, in cases where the movements of the heart could

not be satisfactorily ascertained by the hand, to place his ear over the cardiac region and thus he practiced immediate auscultation.

There was no systematic review of the use of auscultation. One of the first regular reference to auscultation is in the second volume of the series on "Semiologie" in 1817 by E.J. Double (1776-1881), a student of Corvisart. Gaspard Bayle (1774-1816), another pupil of Corvisart, used immediate auscultation to study the heart extensively.

Percussion of the surface of the body for clinical diagnosis was invented by the Viennese physician Leopold Auenbrugger (1722 –1809). He wrote a small book in 1761 "INVENTUM NOVUM" (a New Invention). He described morbid sound – dullness, Corvisart translated Auenbrugger's book into French in 1808.

First Stethoscope; LE Cylinder of Laennec

The first stethoscope of the Breton physician, Rene Theophile Hyacinthe Laennec (1781 – 1826), a student of Corvisart and later physician to the famous Saltpetre and Necker Hospital in Paris, was a unitubular cylinder first made of paper and pasteboard in 1819 and later turned into wooden tube. He named it "LE CYLINDER" – (8 inches long and 1 ^{1/2} inches in diameter). For convenience, it was divided into two portions, one of which screwed into the other, and at one end there was also a removable chest-piece. His contemporaries wanted to call it "somastroscope" or "ethoscope" or "Echophore" because it was used to examine more than just the chest. Laennec described the making of his stethoscope in his book "De L' auscultation mediate", Paris, 1819. In those days, wooden stethoscopes made according to his instructions were sold in Piccadilly, London, for four shillings each. It was monaural and could be applied to one ear only.

There is an anecdote that Laennec described his invention as resulting from his recollection of children listening at one end of a beam of wood to hear the sound as another rubbed the other end. However, there is some controversy about this story.

Another controversial point is whether Laennec knew about the work of the famous British physician, physicist and chemist, William Hyde Wollaston (1766 – 1828) at the time of his invention. In 1810, Wollaston used a long notched stick resting on his foot, with a cushion at one end for the ear to listen to, and counted the sound of muscle contraction in his foot. Laennec did not mention this in the first edition (1819) of his book.

James Hope (1801-1841) a medical graduate of Edinburgh University, and later physician to St. George's Hospital, London, who spent some time in Laennec's clinic in Paris is credited with having influenced the acceptance of the stethoscope by the London medical community. William Stokes (1804-1878) of Dublin, a student (1823-1825) of Edinburgh Medical School, later Regius Professor of Physics at Dublin University, wrote a book "The Use of Stethoscope" in 1925, when he was only 21 years old.

Karl Gastav Schmalz (1775-1849) was one of the first Germans to use Laennec-type stethoscope for pulmonary, cardiac, abdominal and joint auscultation. In 1826, the stethoscope was employed almost universally in France and extensively in Germany and less frequently in England. It was probably first used in the United States of America around 1821-1823.

The following events are important in the development of material technology relevant to the stethoscope

| | |
|--------------------------|--|
| 18 th century | Gutta percha |
| 1820 | Charles Macintosh introduces rubberized fabric/Thomas Hancock introduces an elastic product. |
| 1839 | Charles Goodyear develop vulcanization to resist temperature changes. |
| 1869 | John Hyatt invents celluloid. |
| 1888 | John B. Dunlop patents pneumatic tyre. |
| 1910 | Leo Hendrik Baekeland introduces Bakelite. |
| 1928 | Dupont introduces nylon, plastics industry grows rapidly. |

Industrial progress of the mid to late 19th century proved to be a great bonus in medical instrumentation and the stethoscope benefitted from apparently unrelated discoveries, such as the invention of carbonized rubber and synthetic plastics.

In other words, a wooden monaural stethoscope was evolved into binaural flexible, convenient bedside diagnostic instrument. Arthur Leared (1822 – 1879) claimed to have invented the double stethoscope sometime before 1851, though there is some controversy about it. Combination stethoscope was introduced around 1841 for teaching purposes with the obvious intention to allow four medical students or junior doctors to

simultaneously listen to the same clinical sounds. Francois-Isaac Mayor described fetal heart sounds in 1818, but it was de Kergaradec who first introduced the use of the stethoscope for this purpose. Kergaradec read a memoir on mediate auscultation applied to the study of pregnancy to the Academic Royale de Medicine on Dec.26,1821. The differential (double) stethoscope was introduced in 1858 by Dr.S.Scott Alison, Physician to Brompton Hospital for Diseases of the Chest, London. The purpose was to allow sounds produced at two different points of the chest to be heard at the same time and compared. Electrically amplified stethoscope with the help of microphone was introduced in 1878, but was largely abandoned for many years during the 20th century. In 1999, Hewlett-Packard introduced “The Stethos ” – fully electronic stethoscope.

The major events in the evolution of the modern stethoscope before 1930 are listed below

- | | |
|------|--|
| 1816 | Quire of newspaper, |
| 1816 | Wooden cyclinder. |
| 1828 | Tapered cyclinder with narrow stem, numerous modifications of size, shape, form, ear-piece becomes concave, bell deeper. |
| 1841 | Flexible monaural introduced; evolves into Various combinations. |
| 1851 | Practical binaural introduced; tubing evolves in to more reliable materials with greater flexibility. |
| 1894 | Practical diaphragm introduced; evolves into Bowles type. |
| 1929 | Combination chest-piece, using bell and Diaphragm. |

The mechanism of action of stethoscope is based on the basic principles of acoustics. Sound is conducted through various media according to their density and compressibility. Sound travels faster through wood than through water and air. It has frequency and intensity, energy and velocity. The ability of the observer to hear sound is dependent on both the frequency and the intensity. Humans can discern sound which has energy of about 10^{-16} watt per square centimeter (10^{-11} cm² sec) and between 20 and 20,000 Hz (most physiologic sound has a range of 20-1000 Hz). These principles are followed in the making of stethoscopes.

ANNEX-I : gives the outline of major events in the evolution of the stethoscope.

ANNEX-II : Lists the various types of stethoscope developed so far and patented in different countries – Great Britain, France, Germany, U.S.A. etc. The total number of patented stethoscopes (87) are graded as follows:

1. Rigid monaural – 24.
2. Flexible monaural – 3.
3. Binaural with Rigid Tubes – 28
4. Binaural with flexible Tubes – 17.
5. Obstetrical – 8.
6. Miscellaneous Types – 7.

Popular Reactions

The reaction to the stethoscope was mixed at the time of its origin. Some lamented that the stethoscope distanced the physician from the patient. Others have lauded the dignity it restored to the patient.

Acceptance of the stethoscope after its invention by Laennec was relatively rapid for a profession which is so conservative in nature, although not universal. Public and professional scepticism remained. The London Times of 1824 reported.

“A wonderful instrument called the Stethoscope, invented a few months ago, for the purpose of ascertaining the different stages of pulmonary affections, is now in complete vogue at Paris. It is merely a hollow wooden tube, about a foot in length (a common flute, with holes stopped and the top open, would do, perhaps just all well). One end is applied to the breast of the patient. The other to the ear of the physician, and according to the different sounds, harsh, hollow, soft, loud etc., he judges of the state of the disease. It is quite a fashion if a person complains of a cough, to have recourse to the miraculous tube, which, however, cannot effect a cure, but should you unfortunately perceive in the countenance of the Doctor, that he fancies certain symptoms exist, it is very likely that a nervous person might become seriously indisposed and convert the supposition into reality.”

It is evident from this quotation that the new instrument caused a considerable amount of anxiety among the lay public as well as among practicing physicians.

An often quoted example serves to illustrate the association of the stethoscope

and medicine in a lighter vein. A poem about the stethoscope was composed by the writer, Oliver Wendell Holmes about 1848. Although this poem has a satirical note, Holmes was in fact an early supporter of the stethoscope and he won the Boylston Prize for his essay "Direct exploration" in 1836, which promoted its use. The essay contains a virulent defense of the use of new methods of diagnosis and of the stethoscope. The stethoscope clearly had strong advocates in the United States, England, Germany and France, as well as its detractors. Holmes poked fun at its use in his poem (Holmes 1856).

STETHOSCOPE SONG

By

Oliver Wendell Holmes (1809 –1894)

There was a young man in Boston town. He bought him a Stethoscope and new, All mounted and finished and polished down, with an ivory cap and a stopper too.

It happened a spider within did crawl, And spun him a web of ample size, Wherein there chanced one day to fall A couple of very imprudent flies.

The first was a bottle-fly, big and blue, The second was smaller, and thin and long; so there was a concert between the two, Like an octave flue and a tavern gong.

Some said that his liver was short of bile, And some that his heart was over size, While some kept arguing all the while, He was crammed with tubercles up to his eyes.

This fine young man then up stepped he, And all the doctors made a pause' Said he, "The man must die, you see, By the fifty seventh of Louis's laws.

But since the case is a desperate one, To explore his chest it may be well: For if he should die and it were not done, you know the autopsy would not tell."

Then out his stethoscope he took, And on it placed his curious ear, "Mon Dieu" said he, with a knowing look, "Why here is a sound that's mighty queer

"The bourdonnement is very clear. Amphoric buzzing, "said all the five.

"There's empyema beyond a doubt; We'll plunge a trocar in his side." The diagnosis was made out, they tapped the patient' so he died.

Now such as hate new-fashioned toys Began to like extremely glum; they said that rattles were made for boys, And vowed that his buzzing was all a hum.

There was an old lady had long been sick, And what was the matter none did know ; Her pulse was slow, though her tongue was quick ; to her this knowing youth must go.

So there the nice old lady sat, With phials and boxes all in a row; She asked the young doctor what he was at, To thump her and tumble her ruffles so.

Now, when the stethoscope came out, the flies began to buzz and whiz: Oh,ho: The matter is clear, no doubt: And aneurism there plainly is.

The bruit de rape and the bruit de soie, And the bruit de diable are all combined; How happy Bouillaud would be, If he a case like this could find:

How, when the neighbouring doctors found A case so rare had been described, they every day her ribs did pound In squads of twenty; so she died.

Then six young damsels, slight and frail, Received this kind young doctor's cares; They all were getting slim and pale, And short of breath on mounting stairs.

They all made rhymes with "sighs" and "skies", And loathed their puddings and buttered And dieted, much to their friend's surprise, On pickles and pencils and chalk and coals.

So fast their little hearts did bound, The frightened insects buzzed the more; so over all their chest he found The rale sifflant and the rale sonore.

He shook his head: there's grave disease, I greatly fear you all must die; A slight post-mortem, if you please, surviving friends would gratify.

The six young damsels wept aloud, which so prevailed on six young men that each his honest love avowed, Whereat they all got well again.

This poor young man was all aghast; The price of stethoscopes came down; And so he was reduced at last To practice in a country town.

The doctor's being very sore, A sthethoscope they did devise That had a rammer to clear the bore, With a knob at the end to kill the flies.

Now use your ears, all you that can, But don't forget to mind your eyes, Or you may be cheated, like this young man, By a couple of silly, abnormal flies.

The Epilogue

Laennec, the golden boy from Quimper, Brittany, France (his statue may still be seen there) commenced his medical career by assisting his uncle, a physician at Nantes. He studied medicine under Corvisart and Guillame Dupytren (1777-1835) in Paris. He not only described the sounds heard by stethoscope, coining new terms as pectoriloquy (exaggerated bronchophony indicative of cavitation or consolidation in the lung), aegophony (tremulous resonance heard in pleurisy), crepitations (crackling sound), ronchi but in the second edition (1926) of his celebrated book – “Traite de l’ auscultation mediate”, Paris, he added a detailed account of the diseases of the chest as then known, making his book of permanent historical value. He liberally acknowledges the labours of others, mentioning for example that “the employment of the new method must not make us forget that of Auenbrugger” – the right attitude for a great man that Laennec was. Auenbrugger introduced percussion in clinical medicine in 1761.

He was attacked by tuberculosis earlier in his life. In 1822, he accepted the Chair of Medicine in the College of France. By irony of fate he died four years later at the age of forty-five years in 1826 of the disease, pulmonary tuberculosis, which he had done so much to elucidate.

Among the luminaries who crowd the column in the history of evolution of the stethoscope, Laennec shines and shines alone as a star.

R_x A Medical Myth

Medicine, throughout history, evolved as a splendid blend and a cascade of science, art, magic, folklore, fantasy, philosophy, religion and mythology. Still today, much of medicine is a myth, wrapped in mystery inside an enigma.

Nostalgia is an insatiable human curiosity. It is a virtue. The origin of “R_x”, which precedes all medical prescriptions till today, is still a matter of great curiosity to medical historians. Doctors of today reflexly put - “R_x” at the beginning of prescriptions without knowing or thinking what it means or what it stands for. Archives of the antiquity give an insight into its origin. Wisdom and thoughtfulness of the antiquity always amazes us even today.

The medical dictionaries describe “R_x” as a symbol of recipe in a prescription.

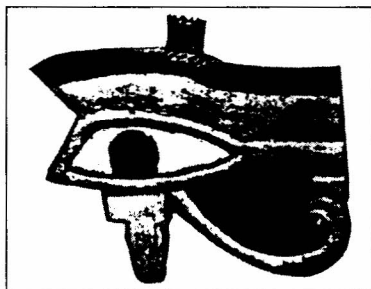
It is always used with dignity and decorum. But still it is a riddle wrapped in mystery inside an enigma.

We know very little about the state of medical practice in Egypt around 4000 B.C. There were various gods who presided over the arts and sciences (Budge, 1904). King Horus the son of Isis and god of health, engaged in a fight with Set, the demon of evil and lost an eye. However, the lost eye was restored by miraculous means. The eye of HORUS formed the design for a charm or amulet which was second only to the scarab or sacred beetle as a mascot of ancient Egypt. It is said to be the origin of the recipe (“R_x”) sign which preceded medical prescriptions (Comrie, 1909).

In a more simplistic way, “R_x” is an abbreviation for recipe, and the bar across its lower limb is an invocation to the god of health. However, it looks quite secular. It all originated from Greek myths.

Ancient Egyptian enamel charm is known to represent Originally an elaborate design, passed through various phases until it became conventionalized as something resembling a capital R, and it was placed on all objects associated with danger, such as ships, chariots and prescriptions. Whatever may be its origin in the antiquity, it is still with us alive and exciting. It seems history of medicine is more interesting than medicine itself.

THE EYE OF HORUS



ANNEXURE – I

Major Events in the Evolution of the Stethoscope

| INVENTOR | DATE | EVENT |
|------------------------------|-------------|---|
| Hippocrates | 350 BCE | Describes the “succussion splash” |
| Auenbrugger J | 1761 | Introduces percussion |
| Corvisart J | 1808 | Laennec’s teacher, translates Auenbrugger, practices immediate auscultation. |
| Laennec R | 1816 | Invents the stethoscope using rolled paper, wood cylinder, experimented with different forms. |
| Double E | 1817 | Discusses immediate auscultation in his text. |
| Laennec R | 1819 | Text on auscultation |
| LeJumeau J.A (Kergaradec) | 1821 | Used stethoscope in obstetrics |
| Hans C.J | 1823 | Publishes monograph on auscultation in obstetrics |
| Laennec R | 1826 | 2 nd edition, expanded, modified original model of stethoscope |
| Piorry A | 1828 | Lighter more convenient instrument with tapered stem, pleximeter |
| Comins N | 1829 | suggested a binaural with flexible jointed metal tubes |
| Williams C.J.B | 1830 | Binaural with lead tubes |
| Stroud W | 1832 | Flexible monaural stethoscope |
| Cammann G.P. Clark A | 1840 | Introduce auscultatory percussion, solid stethoscope |
| Landouzy H | 1841 | Teaching model with flexible tubes |

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|---------------------|------|--|
| Bird G | 1841 | Modifies flexible monaural, improved design |
| Williams G.J.B | 1843 | Trumpet-shaped chest-piece |
| Arnold, Barclay, | 1843 | Serial minor modifications making the stetho- |
| Billings, Burrow, | | scope slimmer and more portable, use of multiple |
| Cammann, Clark, | | materials |
| Dobell, Elliottson, | | |
| Pergusson Hawksley, | | |
| Loomis, Quain, | | |
| Stokes and many | | |
| others. | | |
| Leared A | 1851 | Binaural stethoscope of gutta-percha |
| N.B. Marsh | | Patented binaural rubber stethoscope. |
| Cammann G.P. | 1852 | Introduced first practical binaural stethoscope |
| Alison S | 1859 | Differential stethoscope |
| Hogeboom C.L. | 1866 | Suggests use of a membrane on chest-piece |
| Knight E | 1869 | Modifies spring on binaural |
| Pinard A, Pajot, | 1876 | Obstetric modifications, shorter, wider bell |
| DePaul | | |
| Richardson D | 1879 | Uses microphone to amplify stethoscope sounds |
| Boudet | 1882 | Invents portable amplified stethoscope |
| Denison C | 1892 | Hard rubber binaural |
| Bazzi E | 1894 | Phonendoscope |
| A. Bianchi | | |
| Bowles R.C.M | 1894 | Membrane chest-piece with localizing button |
| Sheppard O.H | 1896 | Modern head-piece design evolved from others |
| Bowles R.C.M | 1901 | Modern diaphragm chest piece |

| | | |
|-------------------|-----------|---|
| Sprague H.B | 1926 | Combined bell and diaphragm |
| Littmann D | 1961 | Criteria for light practical modern stethoscope described |
| Various Inventors | 1926/2000 | Numerous modifications introduced, including a truly practical amplified stethoscope and a portable ultrasound device |

SOURCE: M.Donald Blafox: "An Ear To Chest: An illustrated History of the Evolution of Stethoscope", Parthenon Publishing Group, London/New York, 2002, p.xiii-xiv.

REFERENCE

| | | |
|--------------|------|--|
| Budge, E.A. | 1904 | Gods of Egypt, Vol. I pp. 514, 525. |
| Comrie, J.D. | 1909 | Medicine among the Assyrians and Egyptians in 1500 B.C. Edin. Med. Jour. New Series, 2, 101. |

सारांश

स्टेथॉस्कोप का ऐतिहासिक विवेचन

एस. के. मजुमदार

ग्रीस (हिप्पोक्रेटिस का जन्म स्थल) के कोसध्वीप में स्थित चिकित्सा मन्दिर के मूर्ति एसकलपियस के डंडे के अतिरिक्त, चिकित्सक का प्रतिनिधित्व करने वाला प्रतीक स्टेथॉस्कोप जैसा और कोई वस्तु नहीं होगा।

उन्नीसवीं सदी के आधुनिक युग की पूर्व संध्या पर आविष्कार की गयी स्टेथॉस्कोप का प्रस्तुत प्रभावशाली रूप रासायनिक और तकनीकी विधियों का संयोग उत्पादन है। यह चिकित्सकों के रोग निदान सामग्री में एक विलक्षणीय जोड़ है।

सन् 1819 में लिन्नेक महाशय से आविष्कार की गयी यह स्टेथॉस्कोप रोग निदान एवं विभिन्न रोगों में श्रवण निदान हेतु बहुत उपयोगी सिद्ध और महत्वपूर्ण पायी गयी है।