Auenbrugger's contribution to cardiology

History of percussion of the heart

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Percussion of the abdomen as a means of distinguishing between tympanites and ascites dates back into antiquity, but percussion of the thorax starts with Auenbrugger (Fig. 1) whose *Inventum Novum ex Percussione Thoracis Humani* (Fig. 2) was published in 1761, the same year as Morgagni's great work on pathological anatomy. Auenbrugger's discovery of percussion was not entirely fortuitous for his father was an innkeeper, and he must have watched men tapping the wine barrels to find out how full or empty they were. He was also a good musician and wrote the libretto of an opera for which he was ennobled by the Empress in 1784, so that evidently he had a good ear for sound. Born at Gratz in 1722, he studied medicine in Vienna under Van Swieten, graduating in 1752, and later became physician to the Spanish Hospital in Vienna where for seven years 'amid laborious and tedious exertions' he tested his method of percussion by dissections whenever possible and experimented on cadavers by filling the chest with water.

Auenbrugger practised direct or immediate percussion, striking the patient's chest, covered by a shirt, with the finger tips of his gloved hand, first during normal breathing and then in full inspiration. He described the natural percussion sound in different parts of the chest, noting that over the space occupied by the heart the sound loses part of its natural clearness and becomes dull. His observations related mainly to lung disease, but two sections dealt with heart disease, namely section XLVI on dropsy of the pericardium and section XLVIII on aneurysm of the heart.

He divided dropsy of the pericardium into serous and purulent varieties, noting a completely deadened percussion sound such as obtained by striking a fleshy limb. He also described the symptoms such as fainting, unequal pulse, swelling of the neck, and a tendency to fall asleep while sitting with the

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FIG. 1 Portrait of Auenbrugger from Neuberger's facsimile edition.

body inclined forwards, later described as the pillow sign by Blechmann. He defined aneurysm of the heart as a condition of over-distension of its cavities when they became unequal to propel their contents forward, and found a fleshy percussion sound over a considerable space in the region of the heart.

Auenbrugger's treatise proved to be premature as the anatomical conception of disease based on Morgagni took many years to permeate clinical medicine, so that percussion was virtually ignored by the majority of contemporary physicians, though Haller regarded it favourably and Stoll seems to have practised it in Vienna where others were hostile. The treatise was twice republished in Latin and Rozière de la Chassagne included a French translation in his manual on pulmonary disease (1770), stating that though he had not used the method, it seemed free from danger! The credit of introducing percussion into clinical practice belongs to Corvisart who first learned of it from the works of Stoll whose aphorisms he had translated. He tested percussion in his clinic in Paris, described it in his famous textbook of 1806, and published a second French translation of Auenbrugger's *Inventum Novum* in 1808, together with his commentaries based on twenty years of experience.

Percussion attracted little attention outside France until the publication of Laennec's *Mediate Auscultation* in 1819, after which physicians flocked to Paris to study physical diagnosis. Laennec employed direct percussion using his stethoscope to strike the chest. The introduction of mediate percussion by Piorry (1828) soon paved the way for further advances in physical diagnosis. He invented the pleximeter, a small ivory plaque either attached to the stethoscope or used as a separate instrument, applied to the chest with the left hand and struck by a finger of the right hand (Fig. 3). Piorry was the pioneer of topographical percussion, the first to describe absolute and relative cardiac dullness which was to burden generations of students, and the first to measure the size of the heart clinically. In 1851, he published an *Atlas de Plessimétrie*, postulating a specific percussion sound for every organ, so that his *organographisme* became as grotesque as Fouquet's organic pulses. Sansom who attended his classes in Paris related how Piorry was reputed to discover who was in the drawing-room by knocking at the front door! English and American visitors to Piorry's clinic began to use a finger of the left hand as pleximeter, thus initiating mediate percussion as generally practised today. Wintrich intro-

LEOPOLDI AUENBRUGGER
 MEDICINÆ DOCTORIS
 IN CÆSAREO REGIO NOSOCOMIO NATIONUM
 HISPANICO MEDICI ORDINARIJ.
INVENTUM NOVUM
 EX
PERCUSSIONE THORACIS HUMANI
 UT SIGNO
ABSTRUSOS INTERNI
PECTORIS MORBOS
 DETEGENDI.

VINDOBONÆ,
 TYPIS JOANNIS THOMÆ TRATTNER, CÆS. REG.
 MAJEST. AULÆ TYPOGRAPHI.
 MDCCLXI.

FIG. 2 Title page of the *Inventum Novum* from Neuberger's facsimile edition.

duced the percussion hammer for use with the pleximeter so that three methods of percussion were employed, finger to finger, finger to pleximeter, and hammer to pleximeter.

During the second half of the last century, much attention was devoted to percussion in Europe and America, and special treatises on auscultation and percussion multiplied in all languages, the most important being those of Gerhardt and Weil in Germany, Skoda in

FIG. 3 (a) Piorry's pleximeter. (From Piorry, 1851.) (b) Sansom's pleximeter. (From Sansom (1892), reproduced by permission of the publishers, Charles Griffin and Co. Ltd.) (c) Hirschfelder's orthopleximeter. The shaft must be pointed parallel to the heart border. (d) Goldscheider's orthopercussion by finger tip method of Plesch. (From Hirschfelder (1913), reproduced by permission of the publishers, Lippincott Company.)

Vienna, Barth and Roger in France, Austin Flint in America, and Sansom in this country. Much space was given to percussion in current textbooks on heart disease, and Hamernik was entitled professor of auscultation and percussion in the University of Prague in his book of 1858.

The treatises mentioned covered every aspect of percussion of the heart in interminable detail, and though they make tedious reading today we must bear in mind that they relate to the preradiological era when percussion represented a major advance in physical diagnosis. Weil's atlas contained 26 plates portraying percussion outlines of absolute and relative dullness in children and adults, in inspiration and expiration, in horizontal and vertical postures, in hypertrophy and dilatation, and so forth. Brockbank contrived to incorporate some of these details in a single composite diagram (Fig. 4).

Knowledge of percussion arrived in this country largely through Sir John Forbes who translated Auenbrugger's *Inventum Novum* into English and included it in his *Original Cases with Dissections*, etc. (1824). Forbes was employing percussion and auscultation regularly at the Chichester Dispensary as early as 1822, some time before they came into general use in the hospitals of London and Dublin. The master percussor in this country was undoubtedly Sansom who devised his own pleximeter (Fig. 3), outlined the heart on the chest with copying ink pencils, and by applying moist tissue paper obtained a tracing of the percussion outline. He was even able to map out areas of increased density within the cardiac dullness due to calcified valves!

By the middle of the last century, Vienna had superseded Paris as the postgraduate Mecca, and Skoda became the leading

exponent of physical diagnosis in Europe. He sought to explain the percussion sounds in terms of purely physical laws and strongly opposed the ideas of Piorry. His magnum opus, the treatise on percussion and auscultation (1st edn. 1839), went through many German editions and many translations including the English edition by Markham, but it was probably outrivalled by that of Barth and Roger, my copies being the 4th edition of 1854 and the English translation by Newbigging (1842), and Edens cites the 13th edition of 1898. No copy was authentic unless signed by both authors!

Many refinements in percussion of the heart were devised, such as Ebstein's Tasp-percussion (1876) depending on the sense of resistance instead of the sound, Goldscheider's (1905) orthopercussion, and Hirschfelder's (1913) orthopleximeter (Fig. 3). Camman and Clark introduced auscultatory percussion based on experiments in the cadaver and described by Clark in his *Lectures* (1884) and at length by Barth and Roger. One end of a cedarwood rod was centred over the heart and the ear applied to the other end, while percussion was performed from the outlying lung towards the heart, the sound changing abruptly when the heart border was reached. In this way the heart was outlined and various diameters measured. Hirschfelder advocated wrist exercises for five minutes daily which, he claimed, led to a gratifying improvement in percussion performance! Much discussion arose over the merits of light and heavy percussion, most of the experts favouring light percussion which Brockbank advocated especially in private practice! Attempts were made to identify the qualities of the percussion sound in acoustic terms such as tonality, sonority, intensity, and timbre, but these theoretical discussions probably confused rather than helped the average physician. Auenbrugger's original conception of resonance, when the lung is normally filled with air, and dullness, when the air content is diminished or absent, still held good.

The vagaries of percussion are well illustrated in the case of pericardial effusion. Potain gave a clinical lecture (1887) describing the *matité en brioche* with the *encoche de Sibson* on the left border of dullness (Fig. 5). Blechmann (1922) relates how every examination candidate in Paris mentioned Sibson's notch which he nevertheless concluded was a fiction, first because Sibson never described it, and secondly because it does not exist in practice. Sibson's well-known figures of pericardial effusion to which Potain referred related to injection of fluid in the cadaver and not to the

FIG. 4 Percussion of heart after Brockbank. Arrows show order and direction. Horizontal shading means dilatation, vertical shading hypertrophy, diagonal shading dilatation with hypertrophy. (From Brockbank (1930), reproduced by permission of the publishers, H. K. Lewis.)

clinical percussion outline. All the experts were agreed that the change from resonance to absolute dullness was abrupt, without

FIG. 5 Percussion outline in a case of large pericardial effusion, showing Sibson's notch on left border. (From Merklen and Heitz, 1914, 5th edn. reproduced by permission of the publishers, Masson et Cie.)

intervening relative dullness, and that extension upwards to the left second interspace was an important sign. Other legendary signs were Rotch's (1878) dullness in the 5th right interspace, Ewart's basic angle test, and Bamberger's and Ewart's signs at the left scapular angle (Ewart, 1896). The difficult diagnostic problem which confronted our predecessors of distinguishing a dilated heart from a pericardial effusion no longer exists today thanks to angiocardiology and echocardiography. Nevertheless, I have found percussion of much help in the diagnosis of pericardial effusion, and even in recent times I have had to aspirate a haemopericardium in my wards without delaying for radiological examination.

Auenbrugger's discovery had to wait half a century before it came into clinical use in Paris where it was soon overshadowed by Laennec's mediate auscultation which made him famous in his short lifetime. Nevertheless, percussion paved the way to physical diagnosis of heart disease, and as far as the heart is concerned Auenbrugger made fewer errors than Laennec. There is no doubt as to the important role of percussion of the heart in the preradiological era when great advances in cardiology were taking place, and I can do no better than to quote G. W. Balfour's Harveian Discourse of 1887, in which he stated that nowadays when we can ascertain the dimensions of the heart and the state of its orifices with a precision which is almost perfect, we can scarcely realize the state of chaos into which ignorance of percussion and auscultation would plunge us!

With the advent of radiology, the orthodiagram and teleradiogram came into use for measuring the size of the heart, and radiology soon became an integral part of clinical examination of the heart. Doubts as to the value of percussion began to arise and were voiced by Sir John Parkinson in his Lumleian Lectures on enlargement of the heart (1936) in which he emphasized the personal factor in such a subjective method by which students learned to percuss preconceived ideas into the cardiac outline. Whatever the state of affairs today, Auenbrugger's discovery should rank alongside Laennec's as one of the greatest contributions to cardiology in the days when diagnosis depended on the unaided senses.

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