

Getting a feel for percussion

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Summary

When Auenbrugger introduced percussion it was direct or immediate percussion of the chest. Corvisart was the first to recognise that percussion not merely gave a sound but also a sensation to the percussing fingers. When Piorry introduced mediate percussion the sensation was more readily appreciable.

However, there were many astute clinicians who ignored the sensation and these included Stokes, Hope, Latham and Gerhard. To this day some popular handbooks of physical signs do not mention this valuable component of percussion.

Résumé

Quand Auenbrugger popularisa la percussion, il s'agissait alors de la percussion directe ou immédiate de la poitrine. Corvisart fût le premier à reconnaître que la percussion générait non seulement un bruit mais aussi une sensation aux doigts percuteurs.

Quand Piorry introduisit la percussion indirecte, la sensation devint plus facile à apprécier. Cependant il y a eu beaucoup de cliniciens avisés qui n'en tinrent aucun compte, y compris Stokes, Hope, Latham, Williams et Gerhard. Même aujourd'hui, certains manuels connus des signes vitaux ne mentionnent pas cet outil précieux qu'est la percussion.

When Leopold Auenbrugger published his *Inventum Novum* in 1761 he gave a clear description of percussion and its technique. It was immediate or direct percussion of the chest wall. The thorax of a healthy person sounds, when struck'; (1) and 'The thorax ought to be struck, slowly and gently, with the points of the fingers, brought close together and at the same time extended'. (2) He also noted : 'If a sonorous region of the chest appears, on percussion, entirely destitute of the natural sound - that is, if it yields only a sound like that of a fleshy limb when struck, - disease exists in that region.' (3) He encouraged practice : 'Any healthy person may make experience of percussion in his own person or that of other sound subjects; and will thus be convinced, from the variety of the sounds

obtained, that this sound is not to be despised in forming a diagnosis'. (4) His slim volume of 95 pages was the outcome of seven years 'observation and reflexion' [sic]. It contained no mention of the sensation transmitted to the fingers by percussion but he made no claim for this to be the last word on the subject: 'And here, lest any one should imagine that this new sign has been thoroughly investigated, even as far as regards the diseases noticed in my Treatise, I think it necessary candidly to confess, that there still remain many defects to be remedied - and which I expect will be remedied - by careful observation and experience'. (5)

His treatise was published widely, as has been pointed out by Bishop. (6) A second impression of the first edition was made in 1761 and a second edition was published in 1776. (7)

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A French translation of the original Latin was published in Paris in 1770, by Roziere de la Chanssagne (8), who did not understand percussion and confused it with succussion (a splashing sound heard when a patient with an air-fluid level in the chest is gently rocked), and a Latin reprint was included in a three volume work published by Wasserberg in Vienna in 1775 (9). In addition, it was referred to widely. Thus it was reviewed in August 1761 in the *Public Ledger*, a London daily newspaper. There is convincing evidence that the reviewer was Oliver Goldsmith (1728-1774) (10), who had studied medicine in Dublin and Edinburgh in the 1750s. He gave a clear description of the work in some 800 words ending :

'Such are the outlines of this new discovery: whether it may be of use to society or not, there is no necessity for me to pretend to determine, only this may be observed, that the lungs are often, even in the most healthy state, found to adhere to the pleura, and in such a case, I fancy the sound would, in that part, deceive the practitioner; however, I shall not pretend to set my conjecture against his experience. Upon the whole, it is a trial that may be easily made, and to borrow an expression from Dr Rock, «If it cannot cure, it can do you no harm».'(11)

Dr Rock was a quack previously ridiculed by Goldsmith. In addition, Cullen (1710-1790) referred to percussion in his *First Lines of the Practice of Physic* in editions after 1778 (12) and Munro secundus (1733-1817) mentioned it in his lectures, probably in 1772. (13) Albrecht von Haller (1708-1777) (of Berne, previously Göttingen) wrote a very sympathetic review and Ch. G. Ludwig in Leipzig was also enthusiastic.(14)

Nevertheless, his seniors in Vienna, Gerhard van Swieten (1700-1772) and Anton de Haen (1704-1776) were not impressed. They cannot have been unaware of his experiments and it is surprising that van Swieten in particular, who had been a pupil of Boerhaave, and who prac-

tised abdominal percussion himself, (15) failed to appreciate the brilliant innovation. Anton de Haen, who succeeded van Swieten as Professor and shares with him the credit for starting the renowned Vienna School of Medicine, ignored it totally; an attitude perhaps more easily understood because of his life-long contempt for anything new. (16) The physicians' concepts of disease in the eighteenth century had no place for percussion and they remained reluctant to examine patients.

However, 1761 was also the year of publication of Morgagni's (1682-1771) *De sedibus et causis morborum*, which linked morbid anatomy with symptoms and clinical findings. When this approach to medicine began to be adopted at the end of the eighteenth century percussion became excitingly relevant. J.N. Corvisart (1755-1821) was professor of clinical medicine in Paris at the turn of the century, and at the centre of these changes. He became aware of Auenbrugger's work through reading (and later translating) Stoll's *Aphorisms*. Having practised and taught percussion for twenty years he then, in 1808, translated Auenbrugger's treatise into French and added a substantial commentary of his own, thus quadrupling the text. It was accepted enthusiastically ; by 1820 Dr James Clark (1788-1870) was reporting : 'A patient brought to any of the hospitals of Paris with any affection of the chest, is as regularly submitted to this process (percussion) as the English physician would ascertain the state of the pulse'. (17)

One of Corvisart's commentaries is of particular interest: 'But I would add, that, even in those parts of the chest whence, for the reasons stated hardly any sound can be elicited, an experienced operator can generally judge of the state of the parts within from the peculiar and indescribable sensation conveyed by the fingers'. (18) This appreciation of the tactile component of percussion does not seem to have been developed by Corvisart, but it did not escape the

attention of his former pupil RTH Laennec (1781 -1826). Although the first edition (1819) of *De l'Auscultation...* contained no reference to it (this may not be surprising as in the first flush of the new physical signs there was much to be discovered and recognised). However, Laennec wrote in the second edition (1826), following Auenbrugger's recommendation that either the patient wear a shirt or the operator a glove to prevent the noise of contact interfering with the percussion note : 'It is better that the chest be covered and the hand naked, since the glove necessarily diminishes the sensibility of the touch, and because the sensation of elasticity perceived by the operator frequently confirms his judgement in cases where the difference of sound is only doubtful. In every case the perception of the sense of fullness or emptiness conveyed by percussion, is much stronger to the operator than to the mere bystander'. (19) John Forbes (1787-1861) started his renowned series of translations in 1821, making the descriptions of the new skills of physical examination of the patient available in English; he would have become aware of the tactile component of percussion from this translation and that of Corvisart earlier in 1824 (20). Forbes, together with Conolly and Tweedie, edited and published, in 1833-1885, the *Cyclopaedia of Practical Medicine*, a detailed and wide-ranging series of articles reflecting the best medical practice of that time in Britain. Forbes wrote the lengthy section on percussion, commenting :

'in practising percussion, the operator does not form his judgements exclusively from the nature of the sounds elicited. He judges equally from the tactual sensation communicated by the part struck, to the finger; and it sometimes happens that this latter sensation is the more important of the two. For this good reason a bystander can never be so good a judge of the state of parts percussed as he who operates'. (21)

Clearly Corvisart, Laennec and Forbes are describing the same finding. From their descrip-

tions there can be no doubt that they had become aware of the tactile sensation of percussion and were agreed on its characteristics. They will have used it in their practice and steadily increased their skill in recognising the subtle differences found. They were, of course, using direct percussion; their task was to become easier with the introduction of mediate percussion.

In 1826, less than six months before his death, Laennec was present when Pierre-Adolphe Piorry (1794-1879) first announced his new method of percussion: mediate percussion, (22) in which a small thin plate is placed on the chest wall to be struck by the percussing finger. A variety of substances including wood, cork, leather, horn and rubber were tried but Piorry's favourite was ivory. The plate was referred to as the pleximeter and the striking finger as the plexor. Direct percussion was clumsy, uncomfortable or even painful for the patient; it was inaccurate and time consuming. Chevallier (a pupil of Piorry) wrote in 1833 that he found it difficult to get his friends to allow him to practise percussion on them : 'After giving them the first stroke, my colleagues became quite disgusted with the method, although they were most willing to help me and I had employed all the care of which I was capable'. (23) Mediate percussion overcame these disadvantages and quickly became the method of choice. It was but a short step to use fingers both as pleximeter and as plexor. In his treatise of 1828 Piorry refers to several English and American doctors seeking to simplify mediate percussion by using the fingers thus, but it was not his choice. (24) Lesky credits David C. Skerrett of Pennsylvania (1797-1873) with this advance (but gives no reference) .(25) Dr CJB Williams (1805-1889) also refers to Skerrett in this context (but calls him an English physician). (26) It may be that several different physicians in different places progressed to this method at about the same time. Certainly Hope (1801 -1841) was using it in 1831 (27) and probably Stokes (1804-1878)

(28) also. Williams, writing in 1833, refers to having used mediate percussion for four or five years and that using the fingers of the left hand as pleximeter is :

'...so much more prompt and handy, that I have no doubt of its general adoption, to the exclusion of other modes'. (29)

Though initially the tactile component of percussion could only be perceived by the striking fingers in direct percussion, the use of the finger as a pleximeter enabled the sensation to be detected by the fingers of both hands. Winterich, who invented a small hammer for use as a plexor was able to sense a feeling of resistance through it (30) but finger-to-finger percussion became the general practice. By the 1830's the technique of percussion as used to this day had evolved and has not changed since.

However, there was a small group of skilled physicians who appear to have ignored the tactile sensation and it is not mentioned in their writings. The group included William Stokes, James Hope and Peter Latham (1789-1875). In his 1825 treatise on the stethoscope (31) Stokes included six and a half pages on percussion, but makes no mention of finger sensation. Yet, it was early in his career; he was still a student and his experience was thus limited. A decade later in his *Treatise on Diseases of the Chest* (32), published in 1837 and widely acclaimed, he again (though by then it was no novelty) ignores it in a lengthy section on percussion. The book, having been unavailable for some time, was republished in 1882 after his death by the New Sydenham Society. Stokes had not wanted to rewrite it (for a second edition) at an advanced age, so instead he asked Dr Alfred Hudson (1808-1880) to edit a reprint of the first edition and to include some additions which he (Stokes) had made. It also contained a memoir of Stokes' life by Henry W. Acland FRS (1815-1900). In this volume, in a footnote, Hudson takes him to task for making no mention : *'... of the feeling of resistance communicated to the finger in degree*

differing in different disease conditions'.(33) Further, Stokes writing about signs referable to acoustics states : *These have been hitherto divided into those obtained by percussion and by mediate or immediate auscultation; a division which seems to be unnecessary, as both classes of signs being appreciable by the ear alone should be ranged under the general head of auscultatory phenomena' (34).* It seems clear that Stokes did not appreciate finger sensation in percussion.

He may have been hindered by his technique; W. H. Walshe (1812-1892) wrote;

'Whatever pleximeter be employed it should be placed in accurate and firm contact with the surface : for this reason it appears advisable to apply the palmar, and not the dorsal surface of the finger to the chest, when this is the pleximeter used. No extrinsic condition modifies the sound so much as the amount of force with which the pleximeter is applied to the surface; and the finger with its dorsal surface turned to the chest is, in this point of view, comparatively unmanageable. The validity of this objection is however not universally felt; M. Louis, among others, very frequently percusses in this way, and Dr Stokes appears to prefer it'. (35)

It may also be that the tactile sensation is more readily felt by some. Walshe writes :

'... that doubt often exists as to whether the relative resonance on the two sides is unquestionable; and in these cases the condition of the subjacent points may frequently be settled by taking into consideration the amount of resistance. To those persons whose sense of touch is more delicate than a sense of hearing, this source of diagnosis is of especial value'.(36)

H.M. Hughes (37) wrote about distinguishing solid from fluid by combining palpation with percussion. The capacity, however, of appreciating this difference, which is merely one

of degree, is not likely to be obtained but by long habit and experience, and cannot always be appropriated by the most skilful of auscultators' [sic].

Hope devoted more than two pages in his *Treatise on the Diseases of the Heart and Great Vessels* (1832) to percussion but made no reference to finger sensation.(38) Latham wrote in 1836

'But percussion and auscultation are often spoken of, as if they were different things, whereas they are only different modes of appealing to the same sense; for we gather information equally from what we hear, whether we strike the chest or apply our ear to it, or use the instrument'. (39)

Charles Williams occupies a more ambiguous position for, when writing in 1828 about Laennec's remarks on the vibratory sensation felt by the percussor, he (Williams) added '...to those who have sufficient nicety of tact to perceive this distinction, it may give additional evidence not without its value'. (40) Clearly he knew about finger sensation but surprisingly he made no reference to it in his lectures to students given in 1836 and 1837 (41), nor in a more detailed paper on percussion in January 1837 (42), nor again in his ample account of percussion in his contribution to Tweedie's *Library of Medicine* (1840) (43). If he did not teach it, did he not believe in it? Skoda, eager to move on from French empiricism to establishing firm scientific foundations for physical signs, acknowledges the superiority of mediate percussion: The pleximeter renders percussion much less irksome to the patient, and the sounds more distinct', and noted that Piorry: '... who pointed out the fact that in percussing the various organs different degrees of resistance are felt by the fingers; and it would seem as though he considered this resistance of more importance than the percussed sound'. (44) But Skoda makes little further comment and seems less than enthusiastic.

Piorry, writing in 1831, remarks how he came to realise that the reason why his students (listening to him percuss) did not recognise the resonance, which he found so clearly, was because he was feeling the degree of resistance through his finger; when they used the pleximeter they in turn became aware of the sensation. He went on to draw an elegant analogy with that of taste, where two sensations perceived by two distinct organs merge into a single impression. (45)

Paul Guttman (1834-1893) wrote a very successful *Handbook of Physical Diagnosis* first published in 1871 in German and subsequently translated into six other languages. The New Sydenham Society published the English translation of the third German edition in 1877. The chapter on percussion includes more than two pages devoted to 'The Sense of Resistance Accompanying Percussion'. He concluded that when the utmost precision is required:

'... it is better to use the finger... as by this tactile system of percussion the slight resistance of parts permeable to air and the greater resistance of those which are impermeable, are most distinctly appreciable'. (46)

The 'first American textbook to incorporate the newer methods of physical diagnosis' (47) written by Gerhard and published in 1846 (48) failed to mention finger sensation in percussion, but this oversight was corrected by Flint: 'In addition to the acoustic phenomena produced by percussion, with the fingers applied to the chest wall instead of a pleximeter the percussor can appreciate an abnormal *sense of resistance* in certain conditions of disease'.(49) By the second half of the 19th century, in Europe, Britain and America, the tactile component of percussion would seem to have become an established, if subtle, diagnostic physical sign.

In the 20th century the introduction of x-rays resulted in an entirely different setting for the

diagnosis of chest diseases. It was no longer necessary to force percussion and auscultation to the limits of their capability, but they did not lose their importance. It was now possible to achieve a substantial improvement in the interpretation of the physical findings. In spite of the immense improvements in science in this century, it was reported in 1995 that 'chest percussion has not been evaluated by modern acoustic means, so that our present knowledge of the method does not consistently differ from the 19th century approach.' (50) In 1908 Samuel Gee (1839-1911) wrote enthusiastically about percussion with a clear understanding of the importance of finger sensation. (51) In 1920, Hoover (1865-1927), who has been referred to as 'the supreme embodiment of the clinician's art,' (52) wrote with greater intensity about the tactile component, (which he referred to as 'definitive percussion') in relation to mapping the heart size. (53) In contrast, in 1945, Lyle Cummins (1873-1949) was surprisingly timid when he wrote :

'There is, I think, a sensation to be gained with the finger pleximeter which lends a definite precision to the method; a sensation which tends to be lost with the ivory instrument. This however is an individual opinion and must be taken as such.' (54)

(Lyle Cummins was not timid by nature. Born in 1873, he served as a regimental medical officer at the Battle of Omdurman (1898) and before he retired from the Army in 1921 had been mentioned in despatches six times. Subsequently he was professor of Tuberculosis at Cardiff).

The tactile component of percussion is not mentioned in Keele's excellent monograph *The Evolution of Clinical Methods in Medicine* (1963), (55) nor by Nicolson in his chapter 'The introduction of percussion and stethoscopy to early nineteenth century Edinburgh' in *Medicine and the Five Senses* (1993).(56) It is interesting to see in the first edition of Hutchinson's *Clinical*

Methods in 1897 (57) a reference to it:

'Most physicians, however, prefer to make use of the middle or forefinger of their left hand as a pleximeter, and the preference is due not only to the fact that it can be readily adapted to almost any surface, but also that it conveys information additional to that obtained by the percussion sound, as it takes cognisance of the different degrees of resistance which the tissues offer to the percussion note.'

Resistance continues to feature in each edition through to the latest, the 19th edition, published in 1989.(58) In contrast, *MacLeod's Clinical Examination*, from Edinburgh, first published in 1964 (59) up to the latest 9th edition in 1995 (60) does not refer to finger sensation in percussion at all. Another popular text of clinical signs, Chamberlain's *Symptoms and Signs in Clinical Medicine* refers to : '... an increased sense of resistance to the fingers due to a loss of resilience in the tissues.' (61) This appears in the first eight editions, (62) but the 9th (1974) (63) to the 12th editions (1997) (64) have dropped any reference to finger sensation in percussion.

It is reassuring to find that the *Oxford Handbook of Clinical Medicine*, (65) a current best-seller pocket book, popular with house officers, advises the clinician to 'Listen and feel' when percussing'. The art lives on.

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