Cardiology in the days of Laennec

The story of auscultation of the heart

Evan Bedford¹

Laennec's contribution to cardiology has generally been regarded as inferior to that on diseases of the lung, but nevertheless it was to have far-reaching consequences and must be assessed in relation to the contemporary background and to Laennec's education and medical training.

Biographical note

Born in Quimper in Western Brittany in 1781, his mother died when he was 5 and his father, a lawyer, was usually in debt so that Laennec came under the care of his uncles. He (Fig. 1) had a good grounding in Greek and Latin under an uncle who was a priest and he remained an ardent student of the classics. Another uncle, who later became Professor of Medicine at Nantes, took charge of Théophile's medical training at the Hôtel-Dieu Hospital there. Laennec's only modern language was French, though later he also became familiar with the Celtic dialect of lower Brittany.

After serving in military hospitals, he went to Paris in 1801 and was attached to the Charité Hospital under Corvisart. His many activities included lectures on pathological anatomy, editor of the *Journal de Médecine*, and a number of published papers, notably one on peritonitis. He graduated in 1804, his thesis being entitled *Propositions sur la Doctrine d'Hippocrate, Relativement à la Médecine Pratique*.

Immediate auscultation

Hippocrates applied his ear to the chest, Robert Hooke had heard the beating of a man's heart, and Corvisart listened with his ear near the chest. Bayle and Laennec were accustomed to apply the ear directly to the chest in a perfunctory way and Double (1817) published an account of immediate auscultation which he had practised. Examining an obese young woman with cardiac symptoms

in 1816, Laennec was reluctant to apply his ear to the chest and, recalling that scratching one end of a wooden plank was audible at the other end, he rolled a quire of paper into a cylinder which he applied to the praecordium while listening at the other end and 'was not a little surprised and pleased that I could thereby perceive the action of the heart in a manner much more clear and distinct than I have ever been able to do by the immediate application of the ear'.

Mediate auscultation

Laennec then began to experiment with mediate auscultation at the Necker Hospital, finally designing a wooden stethoscope a foot long and one and a half inches in diameter, perforated in the centre and fitted with a plug when used to listen to the heart (Fig. 2). For purposes of portability, it was made in two parts which screwed together. While checking the proofs of his treatise, he was busily manufacturing stethoscopes on a lathe in his room in the country with the idea of presenting a stethoscope to each purchaser of the book, and the publisher was provided with a supply. Thayer (1920) states that every stethoscope in existence at the time of his death was probably made by Laennec himself, and the College of Physicians possesses one of these stethoscopes presented by Laennec to C. J. B. Williams (see Fig. 4).

In 1818, Laennec presented a memoir on his researches to the Academy of Sciences, and in 1819, *De l'Auscultation Médiate ou Traité du Diagnostic des Maladies des Poumons et du Coeur* was published in two volumes. Though his treatise met with some opposition in France, notably from Broussais, it soon aroused interest abroad, and in due course physicians from all over Europe flocked to Paris to gain first-hand experience of the stethoscope.

Unfortunately the effort involved combined with his arduous teaching programme and increasing private practice caused a breakdown in his health and he was forced to

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¹ Address: 5 Dudley House, Westmoreland Street, London W.1.

retire to the country, completely exhausted and evidently already suffering from pulmonary tuberculosis. Nevertheless, he returned to Paris in 1821 and was appointed to the Chair of Medicine at the College of France, with a clinic at the Charité Hospital. A good account of his day's work is given by C. J. B. Williams (1884) who visited Paris in 1825–26. Laennec demonstrated the signs obtained by auscultation in the wards from 10 a.m. to noon, always speaking in Latin at the bedside, after which he either gave a lecture in French or attended a postmortem examination to correlate the anatomical findings with the signs which had been elicited by auscultation. Williams took notes of the lectures and made sketches of Laennec (Fig. 3) whom he described as a frail-looking man of small stature who often became exhausted by his hospital duties. Laennec's own account of his life in Paris was given in a letter to a colleague which was published by Thayer (1920). Rising at 7.30 a.m., he gave consultations while dressing, then visited the Necker Hospital, and rarely had time to return home for lunch before setting out on his visits which lasted until 5.30 p.m., after which he took an early dinner and then set out on another round of visits until 10 p.m., eventually retiring to bed at 11 p.m.

Laennec's contribution to cardiology

In the first edition of *mediate auscultation* he gave an account of his most important discoveries and described the new physical signs elicited by the stethoscope. For the first time he identified two sounds to each heart beat, the first dull and prolonged coincided with ventricular systole, and the second short and sharp he attributed to atrial systole. How he fell into this error is somewhat of a mystery but as long as the sounds were regarded as muscular and the first sound as due to ventricular systole, the only available explanation of the second sound was atrial systole. Harvey and Haller had long ago observed that atrial contraction preceded ventricular, but Laennec concluded that the ear was a better judge than the eye, and that the cylinder provided a better means of studying the motions of the heart than inspection in living animals. His error in regard to the second sound was not realized until Turner of Edinburgh pointed it out in 1828.

Laennec's other important discoveries related to murmurs and thrills; he described three varieties of murmur.

1) The *bruit de soufflet*, simulating the noise produced by bellows when blowing up the fire; (2) the *bruit de lime*, *bruit de scie*, and

FIG. 1 Laennec from a print in the library of the Royal College of Physicians of London.

bruit de râpe, simulating the noise made by filing, sawing, and rasping; and (3) the musical or hissing bellows sound audible only over the arteries. He regarded the *bruit de soufflet* as due to over-distension of the heart with blood and the *bruit de râpe* as due to stenosis of one of the cardiac orifices. He amplified Corvisart's account of thrills (*bruissement*) which he named the cat-like purring (*frémissement cataire*), and he accepted the new leather creak first described by Collin, his *chef de clinique*, as a sign of pericarditis. In the second edition of *mediate auscultation* (1826), he not only repeated his error over the second sound but changing his mind about the significance of murmurs, he fell into worse errors. By 1826 he had evidently encountered functional murmurs in cases presenting no evidence of organic heart disease at necropsy, and this led him to explain murmurs as due to a condition of tension in the heart and arteries. He still regarded thrills as the rule in obstructive valvar disease though he sometimes found

them in its absence and he seems to have ignored regurgitant valvar lesions. He also rejected the new leather creak as evidence of pericarditis and attributed it to a cardio-pulmonary sound.

Saintignon (1904) in his biography of Laennec is severely critical of his cardiology. Undoubtedly his treatise of 1819 was the *editio princeps* in regard to the heart, and if we base our judgement on this, there is no reason to belittle his pioneer contribution to cardiology. Laennec has been described as a cylindromaniac, and it is true that he tended to ignore percussion and palpation in favour of his stethoscope for he had observed the limitations of percussion in Corvisart's clinic, and he found that the impact imparted by the wooden cylinder to his ear enabled him to combine palpation with auscultation.

Unlike the first edition of his treatise, the second was entirely rewritten in the form of a textbook in which the section on the heart added little to Corvisart's *Essai* (1818) apart from auscultation, but nevertheless, it enables us to cast a *coup d'oeil* on contemporary cardiology after Corvisart and Bertin.

In discussing the causes of heart disease, Laennec exaggerated the importance of lung disease and regarded many cases of dilatation and hypertrophy as congenital in origin, though he recognized mitral stenosis as the common cause of dilatation of the left atrium. He was familiar with the works of Allan Burns, Kreysig, Bertin, and Hodgson, and he often cites Corvisart's postmortem findings as well as his own. He devoted a chapter to fatty heart and his description of the dead leaf colour of the myocardium was repeated verbatim in later accounts of this disease. The rather mysterious condition of softening is separately described.

He discusses Sir David Barry's experiments on the influence of atmospheric pressure on the flow of blood in the veins, many of which he had witnessed and which he regarded as a

remarkable addition to Harvey's discovery. Barry mentioned Carson's earlier thesis but was evidently unaware of his later experiments and I don't think that Barry's publication (1825) need be stigmatized as a flagrant plagiarism of Carson as Lord Cohen has suggested (1971).

Laennec regarded angina pectoris as a neuralgia of the heart, and rejected the coronary theory as did many others in France at this period. He treated the pain by passing a magnetic current through the chest, by blisters over the heart, and by digitalis. In regard to treatment of heart disease in general, he favoured the depletive measures advocated by Valsalva and Albertini, namely repeated vene-

FIG. 2 Laennec's stethoscope depicted in plate 1 of the first edition of his treatise (1819), from a copy in the Bedford Cardiological Library, Royal College of Physicians. Fig. 1. The cylinder reduced to a third of actual size. (a) The plug or stopper, (b) lower, (c) upper part, (d) auricular end. Fig. 2. Longitudinal section with plug in place. Fig. 3, with plug removed. Fig. 4. The plug or stopper with copper tube (b) traversing it. Fig. 5. Upper half of stethoscope showing screw (b). Fig. 6. Diameter of stethoscope and its bore, actual size.

section, leeches, starvation, purgation, and diuretics such as acetate of potash, squills, and digitalis; these same measures were advocated for aneurysm.

The obsession with active and passive cardiac aneurysm in Corvisart's clinic naturally led Laennec to investigate the auscultatory signs, and he gives a lengthy and rather confused account of them. In hypertrophy, the impulse was forcible but the sounds were diminished, whereas in dilatation the impulse was feeble but the first sound loud and short like the second sound; this became current teaching for many years. It is worth mentioning that an appendix to the second edition includes an account of uterine auscultation in pregnancy, which his friend Kergaradec had investigated and described in 1822, though there is no evidence that Laennec himself ever employed it.

Curiously enough, stethoscopy was at first less popular in France than elsewhere and most physicians continued to apply the ear directly to the chest in examining the lungs, reserving the stethoscope for examination of the heart. However, patients expected to be auscultated and Trousseau related how a deaf physician always applied the stethoscope – 'il

ausculte toujours – il n'entend jamais'. Working in France in 1926, I was taught to apply my ear directly to the chest to detect the *bruit de galop*, for which purpose the ward sister carried a serviette to cover the chest. I do not recall any of my teachers in London using a monaural wooden stethoscope though Gallavardin was still using one in Lyons.

Sir John Forbes who translated Laennec and Auenbrugger was largely responsible for introducing the stethoscope to this country, and was using it regularly at the Chichester Dispensary before it came into general use in London hospitals. Stokes' *An Introduction to the Use of the Stethoscope* (1825), published before he graduated in Edinburgh, was the first independent account of mediate auscultation in English, and Bowditch's *The Young Stethoscopist* (1846) marked the acceptance of physical diagnosis in America.

Epilogue to mediate auscultation

According to Claude Bernard, a great discovery is a fact whose appearance in science gives rise to shining ideas whose light dispels many obscurities and shows us a new path. By making clinical signs audible as well as visible and palpable, Laennec's stethoscope opened up a new era in physical diagnosis, and many of the visitors to his clinic soon got busy in exploring auscultation of the heart. Bouillaud studied his own heart sounds by attaching a rubber tube to the end of a wooden stethoscope. Many theories on the origin of the heart sounds were postulated, some of them quite grotesque, for example Majendie attributed the first sound to the impulse of ventricular diastole against the chest wall and the second sound to a systolic impulse impelling the base of the heart against the chest. Pigeaux regarded the first sound as diastolic and Corrigan attributed it to atrial systole and the second sound to ventricular systole. Bouillaud was one of the first to favour a valvar origin of the heart sounds, the first due to closure of the mitral and tricuspid valves, the second to closure of the semilunars. The experiments of Hope (1839), C. J. B. Williams (1840), Rouanet (1832), Halford (1860), and many others gradually established the view that the heart sounds were mainly if not entirely of valvar origin, a view strongly supported in this country by Archibald Billing, physician to the London Hospital.

Numerous works on auscultation and percussion were published in the second half of the last century, notably by Skoda (1854), Barth and Roger (1854), Sansom (1892), and Austin Flint (1876). Hamernik in his book

FIG. 3 Sketch of Laennec by C. J. B. Williams from his *Memoirs of Life and Work* (1884).

(1858) was entitled professor of auscultation and percussion in the University of Prague! Many of the sounds and murmurs had been identified by auscultation before the advent of phonocardiography, and we may recall the famous onomatopoeisis of Duroziez, *ffout-ta-ta-rou*, for the signs of mitral stenosis, representing presystolic murmur and snapping first sound, second sound, opening snap, and diastolic rumble, and Potain's elucidation of gallop rhythm and splitting of the sounds. Phonocardiography has enabled us to time sounds and murmurs precisely and to correlate them with haemodynamic events.

I have sought to show how Laennec's mediate auscultation set in motion widespread researches which were to change the face of clinical cardiology, and we may well regard it as an historical milestone second in importance only to Harvey's great discovery. Laennec's achievement was especially remarkable considering that throughout his creative life he was handicapped by increasing ill health yet he continued to struggle on with his teaching and researches.

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FIG. 4 Monaural wooden stethoscope belonging to C. J. B. Williams and now in the Royal College of Physicians.

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Requests for reprints to Dr. D. Evan Bedford,
5 Dudley House, Westmoreland Street, London
W.1.