

THE ACHIEVEMENT OF DOMINIC JOHN CORRIGAN

by

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At an evening meeting of the College of Physicians in Dublin on 19 March 1838, a thirty-six-year-old doctor named Dominic John Corrigan read a paper entitled 'Cirrhosis of the Lung'.¹ The author had graduated M.D. at Edinburgh thirteen years previously and had already attracted the attention of the medical world by his writings on aortic valvular disease in 1832.² It is interesting to note that amongst his fellow-graduates in Edinburgh in 1825 were William Stokes of Dublin and James Hope of London, both of whom later were to oppose some of his opinions. Hope (1830) rightly ridiculed some of Corrigan's earlier assertions on the cause of the apex beat and the heart sounds.³ Stokes was one of those who disagreed strongly with his fellow-countryman's views on the causes of lung fibrosis.⁴

The paper on 'Cirrhosis of the Lung' was published in the *Dublin Journal of Medical Science*, which Robert James Graves had helped to launch six years previously. In his introductory remarks Corrigan apologizes for using the term cirrhosis but says, 'I have thought it better to retain the name than burthen our nomenclature with another. I would rather add an additional fact than a new name to our science.' This sentence conveys some of the characteristics of the man, in whom outspoken speech was combined with intellectual honesty. He described a disease which resembled phthisis, but which he maintained was not. He believed that there were many features common to cirrhosis of the liver and of the lung, and that the same agencies might be operating in both organs. He pointed out that the main feature of cirrhosis of the lung was the formation of fibrous tissue in the interlobular septa, and around the bronchi. Thus bronchial dilatation is secondary to pulmonary fibrosis; the lung becomes smaller and eventually consists of fibrous tissue and dilated tubes. On a page adjoining the article there are some rather crude coloured illustrations of post-mortem specimens demonstrating these changes. Corrigan noted that cirrhosis was primarily an interstitial process, and that the alveoli were not involved.

There follows a description of five patients, varying in age from seven to forty-seven years. Three of these had come to autopsy and, in each, the affected lung was contracted by fibrous tissue and the bronchi were dilated. The two others were still alive when his paper was written, but he strongly suspected that they also were cases of 'cirrhosis of the lung'.

His first case was that of a seven-year-old child, who three months previously had had 'influenza'. The child gradually deteriorated and died. At the post-

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mortem the left lung was normal and there were no tubercles to be found. The right lung, however, when dissected was found to be interlaced with white bands of fibrous tissue; the bronchi were dilated. In the second patient, who also had been under Corrigan's care in Dublin, the disease had lasted as long as thirty years and had affected the right lung. The heart was displaced to the right and again there were no tubercles. This must be one of the earliest references to displacement of the heart resulting from pulmonary fibrosis.

Stokes was aware that old pleurisy may cause displacement of the apex beat, but he does not mention pulmonary fibrosis in his *Treatise on Diseases of the Chest*. The first edition of this treatise had been published in Dublin one year before the appearance of Corrigan's paper, and had been reviewed enthusiastically by Corrigan for the *Dublin Journal of Medical Science*.⁵ In an interesting footnote to his article on 'Cirrhosis of the Lung', Corrigan refers to Dr. Stokes's recently published book, and he points out that the latter was the first to describe the contraction of the chest which sometimes follows the cure of pneumonia.⁶ Corrigan remarks that this contraction is unusual and he postulates that 'it is possible that in the instance noticed, there was deposition of lymph into the interlobular cellular tissue of the lung, which gradually took on the contractile action, constituting the disease here described.' Since the date when this was written was too early for histological examination of the lung tissue, the hypothesis demonstrates Corrigan's keen insight into the pathological anatomy of at least some cases of lung fibrosis. Indeed, this is probably the first reference in the literature to the disease process nowadays termed diffuse interstitial pulmonary fibrosis.

In his book Stokes described the association of emphysema with bronchiectasis in a forty-year-old man. An autopsy had shown considerable emphysema of the right lung but only slight emphysema of the left, in which there were widespread bronchiectasis and fibrosis. The left lung was also contracted. Stokes reasoned that the small amount of emphysema in the left lung allied with the gross emphysema of the right lung formed evidence that this was the primary condition in both lungs. However, in the left lung, he asserted, there was a superimposed bronchiectasis of unknown etiology, which had caused compression 'atrophy' of the lung substance, thus explaining its contraction in comparison with the right. He does not seem to have considered the possibility that the emphysema in the right lung might have been secondary to the pulmonary fibrosis and bronchiectasis in the left.

Stokes, like all the younger generation of physicians of his day, was much influenced by Laennec's original descriptions in his famous work on *Mediate Auscultation*.⁷ He more than once refers enthusiastically to Laennec in his own book on *Diseases of the Chest*, and we know that as a student in Edinburgh, Stokes had written on the use of the stethoscope. This work was published there in 1825 just before his graduation, and he is said to have received £70 for it.⁸ It is not surprising, therefore, that his views on bronchiectasis, lung fibrosis and emphysema reflected those of Laennec. The latter recognized the association of bronchiectasis with fibrosis, but both he and Stokes were convinced that the fibroid condition of the lungs was usually secondary to bronchiectasis.⁴

The third case described by Corrigan in his paper on 'Cirrhosis of the Lung' was one of Laennec's patients. The age of the man is not stated but he gave a twenty-year history of breathlessness, with cough productive of mucopurulent sputum, originating from an attack of pneumonia. On examination, the left side of the chest was found to be one-third smaller than the right, and there was well marked bronchophony at the lower angle of the scapula. Following sudden death from a stroke a post-mortem examination was made: the left lung was reduced to the size of two fists, and the pleura was closely adherent. The whole lung contained large amounts of fibrous tissue; the upper lobe was slate-grey in colour and the lower 'as white as tendon'. There was widespread bronchial dilatation.

The remaining two patients, as mentioned above, were still alive when Corrigan's paper was written. He pointed out the clinical distinction of such cases from phthisis, although, like Stokes, he found that the physical signs in the chest may be similar. In the differential diagnosis of cirrhosis of the lung and advanced phthisis, Corrigan emphasized the long history and absence of wasting in the former, whereas the poor general condition of the patient favoured the latter diagnosis. He refers to the disease as being 'very rare' and there were 'few observations as yet'. He despaired of any agent ever being found to check the progress of lung fibrosis, which he supposed might be due to a low grade inflammatory process.

Referring to treatment, Corrigan advocated an active life and exercise, which he considered would give the sound lung a chance to develop. He especially advocated 'in the female, the discontinuance of the use of stays, or any dress that will press on the thorax'. This was sound advice and represents an early attempt at the institution of breathing exercises in the treatment of pulmonary insufficiency.

Corrigan's conclusions were strongly opposed, even by his compatriots, Graves and Stokes.⁴ He does not seem to have taken into account fibrosis arising in the alveoli themselves, such as might occur in an unresolved pneumonia. Modern readers, too, will notice the omission of any mention of cancer of the lung in the differential diagnosis. Even so, it would be foolish to minimize the value of Corrigan's contribution. He gave a clear clinical evaluation of the signs and symptoms of lung fibrosis, and in his conjectures on the pathology of the disease he showed a remarkable foresight. Previously, the generally accepted view had been that bronchiectasis was the cause of lung fibrosis; Corrigan was the first, not only to question the validity of this supposition, but also to claim that some cases of fibrosis of the lungs are not due to phthisis; and his new approach to the subject formed the basis for much of the subsequent writings on bronchial dilatation in the nineteenth century. His explanation that bronchiectasis may be secondary to pulmonary fibrosis soon became widely accepted. (See Note B, page 178, revised edition of Stokes' *Diseases of the Chest*, 1882.⁶)

CORRIGAN'S PULSE

There must be many who have felt sceptical as to whether Corrigan was the

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first to describe the pulse which bears his name. Cardiologists are well aware of the valuable contributions of Thomas Hodgkin (1829) and James Hope (1831) of London on the subject of aortic incompetence. The palpable, so-called water hammer pulse, was first described, however, by Thomas Watson of London in 1843. What Corrigan described eleven years previously was the visible pulsation in the neck that occurs in such cases. This classical sign is discovered by inspection, and not by palpation, so that the description 'Corrigan's Water Hammer Pulse' is, strictly speaking, incorrect. Raymond Vieussens of Montpellier had in fact described this pulse in 1715 as striking the fingers 'just like a cord would have done, which was very tightly drawn and violently shaken' ('Autant que l'auroit fait une corde fort tendue et violemment ébranlée.' Major, 1932).⁹

CORRIGAN ON AORTIC REGURGITATION

Corrigan's best known contribution to medical literature was an article published in the *Edinburgh Medical and Surgical Journal* on 1 April 1832.² He was then thirty years old, and the opening remarks are typical of his crisp and clear style. The title of the article is 'On Permanent Patency of the Mouth of the Aorta, or Inadequacy of the Aortic Valves'. This title was chosen by the author to explain as simply and clearly as possible what is the basis of aortic regurgitation.

He begins:

The disease to which the above name is given has not, so far as I am aware, been described in any of the works on diseases of the heart. The object of the present paper is to supply that deficiency. The disease is not uncommon. It forms a considerable proportion of cases of deranged action of the heart, and it deserves attention from its peculiar signs, its progress and its treatment. The pathological essence of the disease consists in inefficiency of the valvular apparatus at the mouth of the aorta, in consequence of which the blood sent into the aorta regurgitates into the ventricle.

It is seen from the opening sentence that Corrigan was ignorant of the writings of William Cowper (1706)¹⁰ and Raymond Vieussens (1715)¹¹ on aortic valvular disease. However, neither of these accounts inspired others to contribute similar cases and although Vieussens described the collapsing pulse accurately, he made no attempt to link it with aortic regurgitation.¹² Of greater interest is the claim that Thomas Hodgkin of Guy's Hospital, London, had described the disease more fully in 1827 and 1829.¹³ Hodgkin's papers were read to the Hunterian Society of London and are in the form of two letters to his fellow Quaker, Aston Key (*Lond. med. Gaz.*, 7 March 1829).¹⁴ In the first, dated 1827, he gives the credit for the original observation of a specimen in Guy's Hospital museum to Aston Key. The latter had pointed out to him the condition of the aortic valves, which Key suspected fell back into the ventricle and were inadequate in function. To this condition Hodgkin gave the name 'Retroversion of the Valves of the Aorta'. He describes in more or less detail four cases in the first letter. In the second, written some months later, he adds three more and particularly mentions the case of an athletic young Guy's doctor. He makes special reference to the strong cardiac impulse and a peculiar

double murmur present both in systole and diastole. Hodgkin also noted 'a remarkable thrill in the pulse and the carotids were seen violently beating on both sides'. At post-mortem the aortic valve was deformed and the left ventricle enlarged. He discussed the nature of the murmur and observed that it had 'a double or spondaic character, the one part marking the systole and the other the diastole of the ventricle'.

There is no doubt that Hodgkin recognized several of the more important signs of aortic regurgitation, but his almost casual publication of the letters in a comparatively obscure journal tended to make his work go unnoticed at the time. The wrong has been at least partly redressed by Samuel Wilks (1871) and Sir William Hale-White (1924). Wilks has pointed out that in the year 1827 Hodgkin had more insight into aortic valvular disease than any other man.¹⁵ He was the first to write about some of the more significant clinical and pathological features of aortic incompetence although his account was incomplete.¹⁶ Wilks must also be praised for having rescued from oblivion Hodgkin's original report of the reticulosis which now bears his name.

Another claimant to be the first to describe the clinical features of aortic valve disease was James Hope. He graduated M.D. at Edinburgh in the same year as Corrigan. After house appointments at the Edinburgh Royal Infirmary he continued his post-graduate education at St. Bartholomew's Hospital in London, and in Paris. Hope asserted that Corrigan was ignorant of both his own and Elliotson's publications on aortic valvular incompetence and challenged the Dublin physician's claim to originality; he also declared that Corrigan's description of the pulse in aortic regurgitation was inaccurate.¹⁷

Now in his article in the Edinburgh journal Corrigan describes the pulse as 'full and vibrating', which is, at least, a tolerable description. Hope also seems to have overlooked the laudatory reference to Elliotson's work on the second page of the article; in fact, Corrigan seems to have gone out of his way to include Elliotson's original term of 'Permanent Patency of the Aortic Valves' in the title of his paper. Hope himself, in his earlier articles, missed the association of the jerking pulse with regurgitation at the aortic valve, a fact which was clearly indicated in Corrigan's brilliant paper.² One year before its publication in April 1832, Hope had published the first systematic treatise on diseases of the heart and great vessels; this had been highly praised as 'the best in the English Language'. Ironically this appreciation appeared in the same number of the Edinburgh journal as Corrigan's paper.

At the time, Hope was more interested in the elucidation of the correct significance of the heart sounds than in a particular disease such as aortic regurgitation. Like most physicians of his day he was fascinated by the stethoscope. Laennec had published the first edition of his treatise on *Mediate Auscultation* in 1819. John Forbes of Chichester had written an English translation of this, which must have helped to spread Laennec's opinions.¹⁸ Hope doubted the latter's explanation that the second heart sound is due to contraction of the atria, although he agreed that the first was probably due to ventricular contraction.³ He proceeded to verify this by visiting a veterinary establishment in Oxford Street with a number of his medical and surgical colleagues from

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St. George's Hospital. There a living donkey was stunned 'by a smart blow on the head'. Following a tracheotomy a large bellows pipe was introduced to assist the animal's breathing during the course of a rapid thoracotomy. The observers were now in a position not only to hear but also to see the heart's action and sounds. As a result Hope agreed with Laennec that the first heart sound was indubitably due to ventricular systole. He mistakenly claimed, however, that the second heart sound was due to ventricular diastole. He makes no mention of closure of the heart valves. Later work by Hope and others at St. George's Hospital culminated in the definite statement that the pathognomonic sign of aortic regurgitation is an early diastolic murmur.¹⁹ This conclusion, however, was not reached by him until two years before his tragic death from tuberculosis at the early age of forty in 1841.

Corrigan's views on the heart sounds were no more accurate than Hope's in 1830. An essay of the former's, which had appeared in a Dublin journal, was reviewed in the *London Medical Gazette*, and his views were bitterly attacked by Hope in a later number.³ Space does not permit a comparison of these two colourful personalities, the one born in Stockport and the other in Dublin. Individually they contributed much to the development of cardiology as a science following Laennec's introduction of the stethoscope. It is impossible not to feel some sympathy for the Lancastrian, whose name has not achieved the degree of eponymous fame that still exists for his contemporary.

I should like now to refer briefly to the salient features of Corrigan's article in the Edinburgh journal. In it he gives a full description of the defects of the valves and of the aorta giving rise to regurgitation. These are illustrated by three engravings. There follows a note on the symptoms, which he points out are non-specific and give no clue to the pathological anatomy or its significance. He discusses the physical signs in more detail and it is interesting that the nomenclature introduced by Laennec is accepted by Corrigan, doubtless to give authority to his own statements. Emphasizing the pulse, which, he says, is 'invariably full', he continues:

when a patient affected by the disease is stripped, the arterial trunks of the head, neck and superior extremities immediately catch the eye by their singular pulsation. At each diastole the subclavian, carotid, temporal, brachial and in some cases even the palmar arteries are suddenly thrown from their bed, bounding up under the skin. . . . From its singular and striking appearance, the name of visible pulsation is given to this beating of the arteries.

Mulcahy has pointed out that the use of the term diastole in relation to the timing of the arterial pulsation is permissible as, in those days, arterial diastole was regarded as synchronous with expansion of the aorta, i.e. at the time of ventricular systole.²⁰

In discussing the 'bruit de soufflet' heard in the ascending aorta, in the carotids and subclavians Corrigan mentions the 'frémissement' accompanying it. This is a systolic thrill palpable along the great vessels and synchronous with the audible murmur. Corrigan describes in some detail his experimental work in haemodynamics and its connection with the 'bruit de soufflet'. He concludes that the latter must arise from the turbulence of the blood being ejected into the aorta. His emphasis, therefore, is on a systolic murmur heard

at the base of the heart, but, like Hodgkin, he also refers to a 'double bruit heard in the ascending aorta in those cases in which the deficiency of the valves is considerable'.

Reading Corrigan's lucid clinical description of the disease it is not hard to understand why it so completely eclipsed Thomas Hodgkin's. His paper, however, was concerned with his appreciation of only eleven cases of aortic regurgitation, nine of them in males. This may seem a small number on which to base firm conclusions, but it must be remembered that the author was a medical graduate of only seven years standing, when the paper was published. He was a mere thirty years of age, and probably felt quite honoured to be in charge of a small number of beds in the Charitable Infirmity, Jervis Street, Dublin. These amounted to either six or eleven according to different accounts.⁵

Discussing aetiology, Corrigan noted that his youngest patient was twenty years old and 'in one case the disease followed an attack of acute rheumatism, which had been accompanied with symptoms of pericarditis'. This is probably one of the earliest references to rheumatic disease of the heart. There follows a long description of the progressive symptoms of aortic regurgitation, culminating in death from exhaustion. There is a brief reference again to the pulse, the classical description of which has been incorrectly ascribed to him. 'It has been all through the disease (unless influenced by medicine) full and vibrating, even to within a few hours of death.' He points out the absence of haemoptysis as a symptom thus distinguishing aortic valve disease from mitral stenosis, but goes astray when he states that the lungs after death from aortic regurgitation are 'generally, remarkably healthy'. For a full evaluation of Corrigan's article in the light of modern cardiology, those interested are referred to Mulcahy's excellent paper.²⁰

Corrigan next considers the differential diagnosis of aortic regurgitation from such conditions as mitral valve disease, aneurysm of the arch of the aorta or of the innominate artery, functional high output states and 'asthma'. There is a classical description of the use of the stethoscope in the distinction between aortic and mitral valve disease, though modern readers may be disappointed to find no reference to an aortic diastolic murmur. He is humble enough to admit that he mistakenly described a case in the *Lancet* in 1829 as being one of aneurysm of the aorta only, but which now, in the light of his present knowledge, he considers to have been one of combined aneurysm and aortic valve regurgitation.

Regarding treatment, Corrigan argues cogently against bleeding, quoting the case of a young man in whom this treatment almost proved fatal. On discontinuing it, however, the patient not only started to improve, but recovered so well that he was able to resume an exacting business career. He makes sensible remarks about digitalis and the pulse rate, and he advocates measures to build up the strength of the patient, such as a generous diet of protein and carbohydrate, but with abstinence from alcohol. Finally he said that the patient should be encouraged to lead as normal a life as possible and be reassured against fears of sudden death. Corrigan has been ridiculed for this

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advice in an account of his life written some seven years posthumously.¹³ After an opening statement that 'as a physician Corrigan has received more praise than his due', it comments somewhat harshly: 'His paper shows that he had made some careful observations but he cannot have made many, for he remarks (p. 244) that "assurance can be given against any sudden termination", while the fact is that this form of valvular disease is the commonest morbid appearance associated with sudden and immediate death, and that patients suffering from it are liable to death at any moment.' Nowadays, however, cardiologists agree that sudden death is not usual in aortic regurgitation and Paul Wood has estimated the average life expectancy as twenty or thirty years from its development in rheumatic heart disease.²¹

I have already dealt with other criticisms of Corrigan's work and noted the scepticism with which his claim to originality had been received in London, especially by James Hope. As time passed, however, his extremely clear clinical description of the disease, together with his brilliant attempt at unravelling its pathology, received well-deserved recognition. In France aortic regurgitation was named by Trousseau 'la maladie de Corrigan' and, nearer home, Graves referred to Corrigan's 'very ingenious essay', Stokes remarked of aortic incompetence that 'we owe the diagnosis of this disease to Dr. Corrigan'.¹⁷ Later Corrigan's obituary notice in *The Lancet* referred to his work of 1832 as being 'proof of that discrimination in the study of disease, which has so creditably distinguished him'.²³

It must be admitted by even his most ardent admirers that Corrigan was not the first to describe the pathology of aortic incompetence nor the first to draw attention to the pulse that accompanies it. People still tend to associate his name with this pulse, which was not particularly emphasized by him except with regard to visible pulsation in the carotids. He also remarked on the 'small pulse' of aortic stenosis in contrast to the 'full and swelling' pulse of incompetence. What is perhaps more significant, however, is his scholarly approach to heart disease in general and disease of the aortic valves in particular. His differential diagnosis is still a model of clarity and his views on treatment and prognosis were far in advance of his time.

CORRIGAN'S CAREER

It will be pertinent to end with a brief reference to the highlights of Corrigan's career. Born in one of the poorer districts of Dublin in the year 1802, he was the second son of hardworking and intelligent parents, who spared no effort to secure for him a sound education.²³ It was not until 1841 that he began to receive public recognition. In that year he became a member of the Senate of the newly established Queen's University in Ireland. In 1849 the University of Dublin honoured him by conferring upon him its degree of Doctor in Medicine. Initially turned down at election for an Honorary Fellowship of the Royal College of Physicians of Ireland in 1847, he was finally granted its Licence in 1855 and proceeded to the Fellowship in the following year.

At the time of his rejection he had been criticized severely by Graves because of his membership of the Board of Health. This censure by so famous a physician

was due to the Board's miserly attitude to Ireland's Dispensary Doctors, at that time fighting the ravages of famine and fever. As its one effective member, Corrigan was held responsible for the grossly inadequate payment made by the Board to the general practitioners trying to cope with the results of the famine years from 1845–8. The Board had been set up by the Government to deal with the sufferings of the people and there seems no doubt that Corrigan paid the price for being one of its members by forfeiting the support of Graves and Stokes in his bid for admittance to the College of Physicians. In retrospect, however, it appears that Corrigan was made the scapegoat for the inadequate measures the Government had taken at the time. Indeed in his pamphlet on 'Famine and Fever as Cause and Effect in Ireland', published in 1846, he had pointed out the dangers of malnutrition to the health of the community.⁵

It was no more than his due therefore when, in 1859, he was elected to the Presidency of the Royal College of Physicians of Ireland. An energetic president, it was by his efforts that the College acquired new premises in Dublin and was able to pay for them. In 1864 at the conclusion of his five consecutive years as President, Corrigan presented to the College a stained glass window to perpetuate his memory.

In 1866 he was made a Baronet in recognition not only of his work as a celebrated physician but also of his public service in Ireland. At that time Sir Dominic Corrigan had the most lucrative private practice in Dublin and was a Physician-in-Ordinary to Queen Victoria in Ireland. He was elected to Parliament at Westminster as a Liberal member for Dublin in 1870 and became Vice-Chancellor of the Queen's University in 1871. As a politician he was opposed to Home Rule for Ireland and he spoke out against the Sunday Opening of Public Houses. In his later years he was a member of the General Medical Council and was a staunch exponent of the views of the general practitioners, whose absence from the meetings of the Council he deplored. He had many outside interests and became President of the Royal Zoological Society in Dublin. No doubt he found relaxation in the Zoological Gardens and also at his seaside house on the shores of Dublin Bay, where he had an aquarium.

Corrigan died from a stroke on 1 February 1880. His obituary notice in *The Lancet* a fortnight later, after referring to his best known work on aortic incompetence and cirrhosis of the lung goes on 'We can scarcely praise too highly a man who could show such discernment and who could add to such scientific and professional labours, work as a public-spirited citizen and statesman, which makes his death to be lamented as a national loss.'

Corrigan was a worthy member of that great triumvirate of Dublin physicians of the nineteenth century, Graves, Corrigan and Stokes. He was a man who, by hard work allied to moral integrity, enhanced not only his own reputation but also that of his country throughout the medical world.

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Professor Keith Simpson of Guy's Hospital kindly gave me permission to search in the Gordon Museum for the original specimen of aortic regurgitation mentioned by Hodgkin in the London Medical Gazette of 1829. It was found described as specimen 2451 in the 1910 Catalogue, but seems to be no longer in the Museum.

REFERENCES

1. CORRIGAN, D. J., On cirrhosis of the lung, *Dublin J. med. Sci.*, **13**, 266.
2. — On permanent patency of the mouth of the aorta, or inadequacy of the aortic valves, *Edinb. med. surg. J.*, 1832, **37**, 225.
3. HOPE J., Strictures on an essay by Dr. Corrigan on the motions and sounds of the heart, *Lond. med. Gaz.*, 1830, **6**, 680–687.
— Experimental and clinical researches on the physiology of the heart's action, *Lond. med. Gaz.*, 1830, **6**, 782–789.
4. CLARK, A., HADLEY, W. J., CHAPLIN, A., *Fibroid Diseases of the Lung including Fibroid Phthisis*, London, Griffin, 1894.
5. WIDDESS, J. D. H., *A History of the Royal College of Physicians of Ireland, 1654–1963*, Edinburgh and London, E. & S. Livingstone, 1963.
6. STOKES, W., *A Treatise on the Diagnosis and Treatment of Diseases of the Chest*, 1837, revised edition, 1882, London, New Sydenham Soc.
7. LAENNEC, R. T. H., *Traité de l'Auscultation Médiante et des Maladies des Poumons et du Coeur*, 1819, 2nd edition, 1826, Paris, Claudé.
8. ACLAND, H. W., Memoir to Dr. William Stokes, written as a prefix to the revised edition of *A Treatise on the Diagnosis and Treatment of Diseases of the Chest*, London, New Sydenham Soc., 1882.
9. MAJOR, R. H., Raymond Vieussens and his treatise on the heart, *Ann. med. Hist.*, 1932, **4**, 147–154.
10. COWPER, W., Of ossifications or petrifications in the coats of the arteries, particularly in the calves of the great artery, *Phil Trans.*, 1706, **24**, 1970, quoted by Nathan Flaxman (12).
11. VIEUSSENS, R., *Traité Nouveau de la Structure et des Causes du Mouvement Naturel du Coeur*, Toulouse, J. Guillemete, 1715, p. 107. Quoted by Major (9).
12. FLAXMAN, N., History of aortic insufficiency, *Bull. Hist. Med.*, 1939, **7**, 192–209.
13. *Dictionary of National Biography*, 1887, **12**, 252–253.
14. HODGKIN, T., On retroversion of the valves of the aorta, *Lond. med. Gaz.*, 1827–1829, **3**, 433–443.
15. WILKS, S., Note on the history of valvular diseases of the heart, *Guy's Hosp. Rep.*, 1871, **16**, 211.
16. HALE-WHITE, W., Thomas Hodgkin, *Guy's Hosp. Rep.*, 1924, **74**, 117.
17. DOCK, G., Dominic John Corrigan; his place in the development of our knowledge of cardiac disease. II. The water-hammer pulse, *Ann. med. Hist.*, 1934, **6**, 381–395.
18. FORBES, J., *A Treatise on Diseases of the Chest and Mediate Auscultation*, trans. from the French 2nd edition, London, Underwood, 1827.

19. IRVINE, R. E., James Hope and the history of aortic regurgitation, *Guy's Hosp. Rep.*, 1957, **106**, 1–10.
20. MULCAHY, R., Sir Dominic John Corrigan, *Irish J. med. Sci.*, 1961, p. 454.
21. WOOD, P., *Diseases of the Heart and Circulation*. London, Eyre and Spottiswoode, 1956.
22. Obituary, Sir Dominic J. Corrigan, Bart., M.D. Edin., Dublin, *Lancet*, 1880, **i**, 268–269
23. DIXON, E., Sir Dominic Corrigan, *Dublin hist. Rec.*, 1946, **8**, pp. 28–38, 67–76.