

## **Paradoxical, hyperdiastolic, and hemisystolic pulsation / by G. A. Gibson.**

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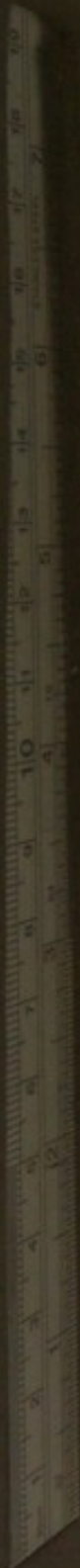
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PARADOXICAL, HYPERDICROTIC, AND HEMI-  
SYSTOLIC PULSATION.

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## PARADOXICAL, HYPERDICROTIC, AND HEMISYSTOLIC PULSATION.

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THE interesting series of pericardial cases, recently treated in my wards, and recorded in this number of the Journal by my house physician,<sup>1</sup> has presented an opportunity of studying certain phenomena which deserve careful consideration. The full details of the cases are given in his clinical records, and need not here be further referred to. Suffice it to say, that two of the patients furnished instances of mediastino-pericarditis, in which the diagnosis formed during life was verified after death; the third patient was an example of simple adherent pericardium, which, notwithstanding close observation, escaped detection, as is so often the case in obliteration of the pericardial sac.

My purpose in this brief contribution is to point out some features of the radial pulse which have struck me in the three cases, and in one previously narrated. My remarks upon the tracings centre mainly in two of the appearances which are presented. In the first place, the presence of hyperdicrotism is well shown in some of the tracings; while, in the second place, the occurrence of hemisystole cannot be denied. This hemisystole, however, is of a kind which has not hitherto, so far as consists with my knowledge, been observed.

The presence of hyperdicrotism during the inspiratory phase of paradoxical pulsation, when the blood pressure is reduced to its lowest level, was apparent in one of the tracings published by my house physicians and myself in a paper last February<sup>2</sup>; as the indication which it afforded, however, was but slight, the fact was not specifically mentioned. In the second series of my Morison Lectures some other tracings from a different patient were figured and described,<sup>3</sup> and the hyperdicrotism was then referred to. A third case is now described in the preceding paper. From each of these three cases of adhesive mediastino-pericarditis a tracing is now shown. In the first of these (Fig. 1) the presence of hyperdicrotism is only to be seen fully developed in the fifth pulsation, none of the other impulses showing more than a fully

<sup>1</sup> *Edin. Med. Journ.*, 1903, N.S., vol. xiv. p. 207.

<sup>2</sup> *Practitioner*, London, 1903, vol. lxx. p. 212.

<sup>3</sup> *Edin. Med. Journ.*, N.S., 1903, vol. xiii. p. 430.



dicrotic pulse. In the second case (Fig. 2) the pulse is seen to be hyperdicrotic throughout, and the condition can hardly be said to be more fully marked during the inspiratory than during the

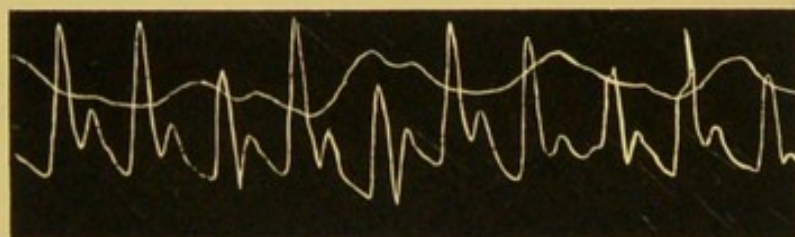


FIG. 1.—Paradoxical pulse from a case of indurative mediastinal pericarditis, showing the respiratory curve as well as the pulse. The rise in the respiratory curve is produced by inspiration. Hyperdicrotism is present in the fifth pulsation, corresponding to deep inspiration.

expiratory phase. In the third instance (Fig. 3) the pulsation never becomes definitely hyperdicrotic, but it is most interesting to notice that during inspiration it becomes fully dicrotic, which is not the case during the expiratory phase. On looking into the full details of this patient, it will be noticed that the paradoxical pulse is almost unilateral; while distinctly present in the right radial artery, it is scarcely perceptible in the left. Such a condition as this has been previously described by Mainzer,<sup>1</sup> Gerhardt,<sup>2</sup> and Harris.<sup>3</sup>

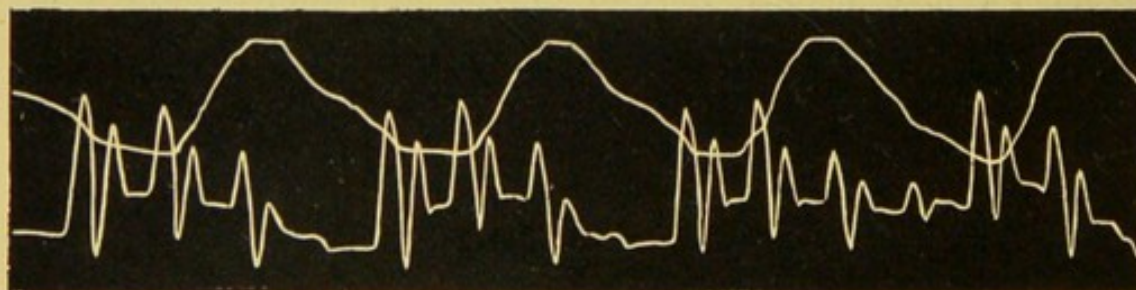


FIG. 2.—Paradoxical pulse from a case of pleurisy and pulmonary consolidation, with adhesive mediastinitis. The respiratory curve rises during inspiration. Hyperdicrotism is present throughout.

Now, when reviewing Mackenzie's deeply interesting work on the pulse, in a recent number of this Journal,<sup>4</sup> it seemed a duty to state my conviction that his explanation of hyperdicrotism,<sup>5</sup> as simply the result of acceleration of the heart, whereby the descending limb of the dicrotic notch is cut short, is not correct. The tracing above (No. 2) seems to be sufficient to disprove the

<sup>1</sup> *Prag. Vrtljschr.*, 1879, Bd. i. S. 93.

<sup>2</sup> *Berl. klin. Wchnschr.*, 1897, Bd. xxxiv. S. 4 u. S. 285.

<sup>3</sup> *Lancet*, London, 1899, vol. i. p. 1072.

<sup>4</sup> *Edin. Med. Journ.*, N.S., 1903, vol. xiv. p. 59.

<sup>5</sup> "The Study of the Pulse," Edin. and London, 1902, p. 26.



explanation. When that tracing is carefully studied, it can be clearly seen that the descending limb of the dicrotic notch is not cut short by the next pulsation—that the dicrotic notch, on the contrary, is fully completed before the subsequent pulsation

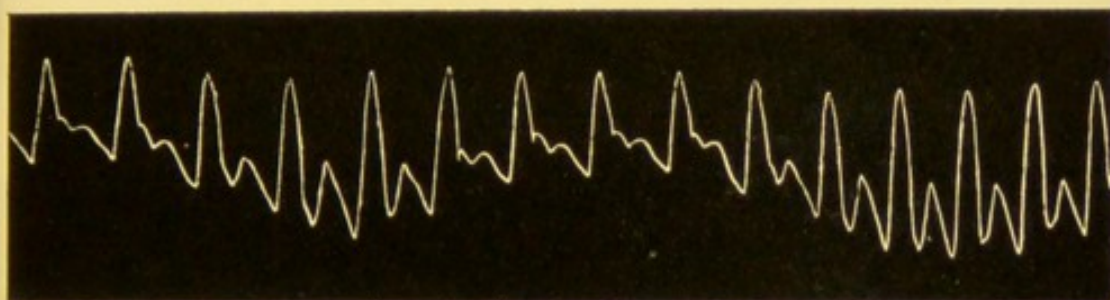


FIG. 3.—Paradoxical pulse from adherent pericardium, with indurative mediastinitis. The tracing does not show hyperdicrotism, but during inspiration the curve is fully dicrotic.

occurs. In order, however, to make this matter absolutely clear, three other tracings (Figs. 4, 5, and 6) are subjoined. Two of them

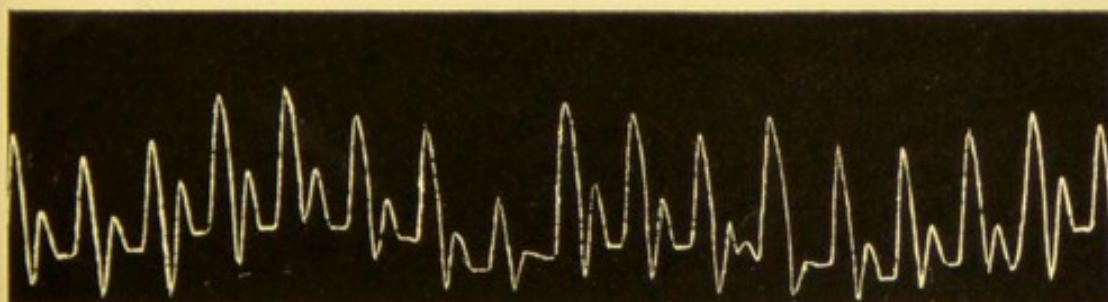


FIG. 4.—Tracing of pulse in mediastino-pericarditis, showing hyperdicrotism throughout.

are from the two cases of indurative mediastino-pericarditis, described in detail in this number of the Journal by my house

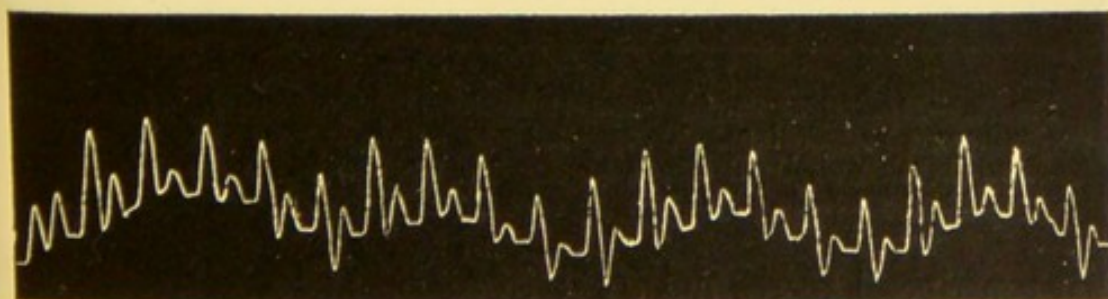


FIG. 5.—Tracing of pulse in mediastino-pericarditis, showing hyperdicrotism during the phase of inspiration.

physician, and show well-marked paradoxical pulsation; the third is from a case of organic mitral disease, manifesting hyperdicrotism without the occurrence of any enroachment upon the dicrotic notch



by subsequent pulsation. The existence of such tracings is sufficient in itself to demonstrate that Mackenzie's conclusions, in regard to the origin of hyperdicrotism, are at least too absolute. It is only right to add that he himself admits that this may be the case, for, in a private communication to me he says<sup>1</sup>:—"I readily admit there may be other instances which I have not met." On the other hand, it is but just on my part to state my conviction that Mackenzie's views are of very general application.

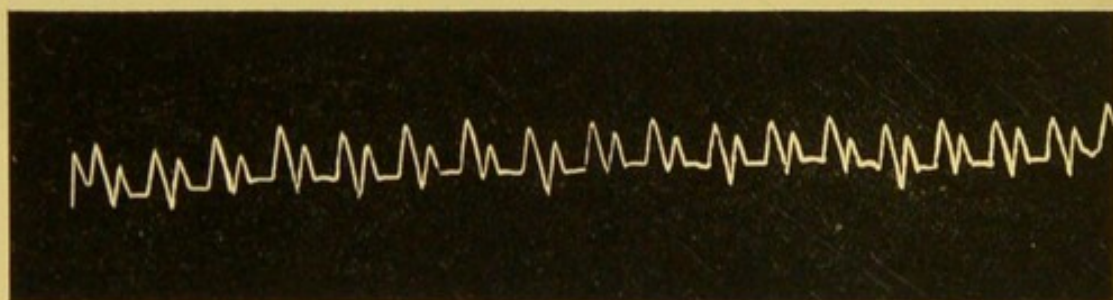


FIG. 6.—Tracing of pulse in mitral disease, showing hyperdicrotism during most of the curve.

The flow of fluid through elastic tubes still remains one of the most abstruse subjects connected with the circulation, and in spite of the labours of many observers there are many points as yet obscure. Amongst these vexed questions, dicrotism must be regarded as one of the most difficult. It cannot be doubted that the dicrotic wave is of centrifugal origin, although it is certain

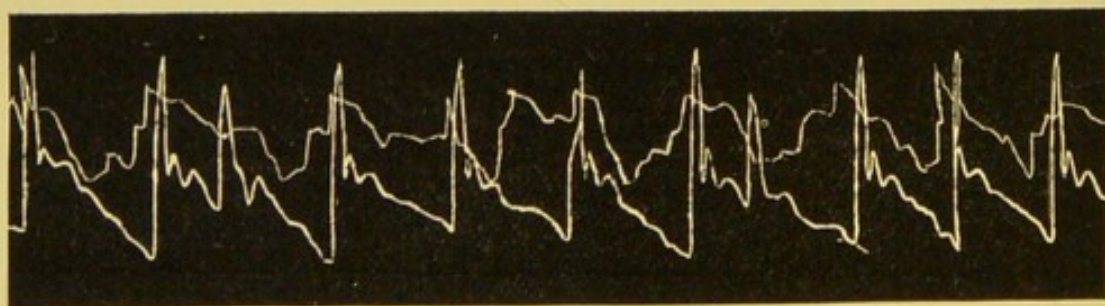


FIG. 7.—Tracing of radial pulse (below) and jugular pulse (above) in adherent pericardium. The second and third, as well as the seventh and eighth radial pulsations, are grouped or bigeminal, but the jugular pulsation is not doubled.

that centripetal forces modify it to some extent. Its amplitude may be taken to vary inversely with the arterial pressure, and for the occurrence of hyperdicrotism the one constant factor is a low level of that pressure. In this connection it is therefore a matter of real interest to find hyperdicrotism, during the phase of inspiration, in the paradoxical pulse.

Let us now turn to the other subject which arises out of the

<sup>1</sup> Letter dated July 13, 1903.



consideration of the pericardial cases which have been described. One of the tracings appears to be an instance of the condition known as hemisystole. By this phrase is meant the contraction of one side of the heart, while the other does not beat, or pulsates at most feebly. This conception has been somewhat difficult of acceptance by me, on account of what we know in regard to the structure of the heart. The circular fibres of both sides of the heart are so closely associated that it is not easy at first sight to grant that one-half may contract without the other. Some of Mackenzie's tracings,<sup>1</sup> however, have convinced me that there is a possibility of this condition of hemisystole. Now the tracing (Fig. 7), which illustrates the pulsation of the internal jugular along with the radial pulse, is most interesting, since it shows hemisystole, but not the kind of hemisystole revealed by Mackenzie's tracings, in which the right side sometimes beats with no apparent pulsation of the left side of the heart—tracings which, in the main, accord with and support the contentions of Leyden<sup>2</sup> and Roy<sup>3</sup>; but it demonstrates that there may be a hemisystole, in which the left side beats without any corresponding contraction of the right. If my interpretation of the curve is correct, it will be seen that twice in that tracing there are actually two pulsations of the radial artery for one of the jugular veins. This can be observed in the two bigeminal or grouped pulsations, second and third, and seventh and eighth, in the tracing. This can only mean that the left side of the heart has, on these two occasions, beat without any corresponding pulsation of the right side. The patient from whom the tracing was obtained was nearing his end, and such abnormal pulsations have usually been observed in those who are approaching the termination of life.

<sup>1</sup> *Op. cit.*, p. 294.

<sup>2</sup> *Virchow's Archiv*, 1868, Bd. xlv. S. 365; and 1875, Bd. lxxv. S. 153.

<sup>3</sup> *Edin. Med. Journ.*, 1878, vol. xxiii. p. 594.



The first of these is the fact that the United States is a young nation. It is only about 150 years old, and its history is therefore a history of rapid growth and development. The second is the fact that the United States is a large nation. It covers a vast area of land, and its population is one of the largest in the world. The third is the fact that the United States is a diverse nation. It is made up of many different peoples, languages, and customs, and this diversity has been one of its strengths. The fourth is the fact that the United States is a nation of immigrants. Many of its citizens are the descendants of people who came from other countries, and this has helped to shape its culture and identity. The fifth is the fact that the United States is a nation of pioneers. Its history is filled with stories of people who went to new lands and built new lives, and this spirit of adventure and exploration has been a key part of its character. The sixth is the fact that the United States is a nation of freedom. It is a country where people are free to express their opinions, to follow their dreams, and to live their lives as they see fit. This freedom has been one of its greatest achievements, and it has helped to make it a model for other nations. The seventh is the fact that the United States is a nation of progress. It has been at the forefront of many of the most important technological and scientific advances of the modern world, and this progress has helped to improve the lives of its citizens and the world as a whole. The eighth is the fact that the United States is a nation of hope. It is a country where people believe in a better future, and this belief has helped to drive its progress and development. The ninth is the fact that the United States is a nation of unity. Despite its diversity and its many challenges, it has managed to remain a united people, and this unity has been one of its greatest strengths. The tenth is the fact that the United States is a nation of peace. It has been a country where people have learned to live together in harmony, and this peace has helped to make it a more stable and prosperous nation. These ten facts are just a few of the many things that make the United States a unique and important nation in the world. Its history is a story of growth, development, and progress, and it is a story that continues to inspire and guide us today.





