ON
PULSE-BREATH.

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AFFECTED WITH DISEASES OF THE CHEST.

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THE term pulse-respiration is often used to designate the ratio which exists between the frequency of the pulse and the number of the respirations in a given time. By the term "pulse-breath," I wish to signify something quite different—namely, an audible pulsation communicated to the breath as it issues from the mouth by each beat of the heart.

In some cases of long existing valvular disease of the heart the characteristic morbid sound, whether rasping, or soft and musical, is audible at a certain distance from the patient at all times, provided perfect silence be observed. And in a still larger number of cases of this class the morbid sounds, which at other times are inaudible without close examination of the chest, are occasionally to be heard at a short distance from the patient, when from any cause the action of the heart happens to be unusually excited. And in chronic phthisis, when the stethoscope is placed over a

tolerably empty cavity situated sufficiently near to the heart to receive the impulse of its beat, the amphoric clearness with which the cardiac sounds are heard is familiar to all experienced auscultators.¹ But the sound to which I seek to direct attention has no connection with any cardiac murmur, nor with any abnormal pulmonic sound. It is simply an audible pulsation of the breath as it issues from the patient when he holds his mouth open and breathes as gently, and with as little of the ordinary noises of respiration, as possible. The sound is that of a gentle gushing of the breath, synchronous with each pulsation of the heart, and such as any one may imitate voluntarily so far as the character of the sound is concerned. The degree of audibility varies in different cases, and in the same case under varying circumstances. I have heard it so loud that I could count the pulse by it at a distance of fifteen feet, and so subdued as to need listening close to the patient's face for its detection.

The first case in which I noticed this phenomenon was that of a Somersetshire gentleman, in 1851 (Mr. L—, of Stapleton), who had been, until leaving for Torquay, under the care of Dr. W. Budd. He was phthisical, and had a very large cavity coming to the front in the upper lobe of the left lung. All the characteristic stethoscopic signs—gurgling, splashing, metallic tinkling, cracked-pot sound, cavernous respiration and voice, were present to a marked extent at different times, according to the fulness or emptiness of the cavity; but on rare occasions I also found this phenomenon of “pulse-breath,” so that I could count his pulse by it when I was sitting opposite to him.

On the first of these occasions the patient had been a good deal hurried by an attack of vomiting, and I therefore

¹ Walshe on ‘Diseases of the Lungs,’ 3rd ed., p. 445, § 1370. A work almost mathematical in the concentrated attention which it requires, and in the minuteness, exactness, and completeness of the knowledge with which it repays it.

found him under the two conditions of cavity cleared of its liquid contents, and circulation excited. On my next visit the sign was not present. On every future occasion on which I heard the "pulse-breath" in this patient, the cavity was empty. When the phenomenon was not present, the cavity contained more or less of liquid. This patient died in the last stage of phthisis, from pericarditis.

The second case of phthisis in which I observed "pulse-breath," was that of a Shropshire gentleman (Mr. B—), who had a large excavation in the left lung, adjoining the base of the heart. During the stage of softening, in 1857, this patient came under the notice of Dr. Cotton. His lung broke down after his coming to Torquay, in the winter of 1857. Previously to excavation moist crackle was universal throughout the left lung, but gradually subsided after the formation of the cavity. Since the cavity has become old and its walls condensed—it is now the size of a Seville orange—I have, from time to time, observed the "pulse-breath," but never to so marked an extent as on one occasion, when I happened to visit Mr. B—, after he had had an accidental attack of vomiting. Whilst the patient stood still, with his mouth slightly open, and breathing quietly, I retreated from him until I had reached a distance, by measurement, of fifteen feet, and was able, anywhere within that limit, to count his pulse by listening to his breath—not to his *breathing*—for that of course had a different rate, but to the "pulse-breath." Indeed the sounds of respiration could not be heard nearly so far from the patient, being intentionally kept by him as noiseless as possible.

The mechanism of the production of the phenomenon in these cases seems to be very evident. A large cavity old enough to possess walls of sufficient density, which is not immediately separated from the heart by permeable or crepitating lung, or any other intermediate soft texture which could act the part of a damper, and which is tolerably dry

for the moment by being emptied of its customary contents, vibrates in accordance with each beat of the heart, and at each vibration throws the air in the cavity, trachea, larynx and mouth, into a sonorous pulsation. When the cavity is more or less filled with liquid, it no longer vibrates; and as this is the habitual state of a cavity which has not collapsed, the phenomenon of "pulse-breath" is not ordinarily present even in such cases as can manifest it under fitting conditions.

Such a cavity as will produce the cracked-pot sound in perfection, provided it be sufficiently close to the heart, might, *à priori*, be expected to furnish an example of "pulse-breath."

But my next example is one less easy of explanation.

A Northamptonshire gentleman (Mr. L. R—), æt. 45, who was of such herculean build and stature that he was accustomed to astonish his friends in Paris by the large girth of the calf of his leg, who was fond of all active sports, and was in the habit of hunting three or four days a week without feeling fatigue,—on one occasion, about three years ago, when returning from hunting, was almost too late for his train, and ran too far and too fast, being stout and of full habit at the time. On reaching the railway carriage much out of breath, he felt overcome and faintish. From this time, having previously enjoyed excellent health, he dates a series of slowly increasing ailments.

At different times this gentleman came under the notice of the late Dr. Addison, of Drs. Gairdner, Tyler Smith, Sibson, Francis, Williams, Jenner, and Symonds.

The case is one of cardiac disease with enlarged liver, pulmonic congestion, leaky kidneys, general anasarca of lower extremities, sometimes œdema of genitals, and occasional slight attacks of gout.

A soft, systolic, mitral bellows-sound, is the only morbid bruit, but the extent of cardiac dulness is increased towards the sternum, and although there is no pulsation of the

jugular veins, it is probable that all the cavities of the heart have undergone some amount of dilatation.¹ In front of the upper lobe of the left lung there is dulness and defective respiration. No other morbid change is observable in the breath-sounds, both inspiration and expiration being soft, and as dry as is compatible with softness. There is occasional hæmoptysis, never exceeding a few ounces, and occurring once in two or three months. A good deal of dyspnœa and of blueness of lips and cheeks occurs on exertion or on exposure to cold. Legs bronze-coloured below the knees, from capillary congestion and minute ecchymoses.

¹ The considerable degree in which the systemic circulation suffers is scarcely explicable without assuming that the right side of the heart participates in the affection. Does not the absence of jugular pulsation, in cases such as this, support Dr. Parkes's view, that a yielding of the valves where those veins join the subclavians is essential to the production of jugular pulsation? The slightheadness and softness of the mitral bruit in a case like this, where the general condition indicates very considerable faultiness of action—whereas in other cases we may have a *loud* bellows-sound, or a sharp, rasping bruit, with almost no systemic disorder for many years—seems to imply that the loudness of the bruit is by no means a criterion of the degree of valvular insufficiency. It is possible (though not proved) that the quality of the morbid sound rather indicates the nature of the valvular morbid alteration than the amount. Thus, a rough sound may possibly imply roughness of surface from puckering of valve, or from concretion. But the converse does not hold good. A smooth murmur by no means of necessity implies that the faulty valve has a smooth surface. Nor does a slight and soft murmur imply that there is only a slight and trivial inadequacy of valve. Nor, on the other hand, does a loud bruit imply that there must be very considerable inadequacy. Loudness of murmur is promoted by thinness of blood, thinness of walls of thorax, and thinness of walls of heart; also, by a jerking character of the heart's systole. None of these conditions are present here. Perhaps the most common case in which the heart is gravely diseased, and yet presents little or no morbid sound, or only a slight "whiff" occasionally, when the action of the heart happens to be unusually forcible, is that of mitral constriction not yet admitting of reflux, with weak heart, and large, bulky body. In the case before us, Dr. Jenner was of opinion that the dropsy must be looked upon as not being entirely due to the primary cardiac disease, but in part also to the secondary renal affection.

Occasionally there is some albumen in the urine, but this may remain absent for a month at a time, or longer. Once in three or four months a moderately smart attack of gout habitually occurs in one of the œdematously swollen feet.

In this patient a soft, gentle "pulse-breath" is *never* absent when the mouth is held open. It is audible when the patient is asleep, and during waking hours is rendered considerably louder when the action of the heart is unusually excited.

The origin of the disease seemed to me to consist in straining of the mitral valve by the forcible running after the railway train, when the body from plethora was in a bad condition for such sudden exertion. In this view Dr. Jenner coincided.

A person in health by running until he is out of breath, may sometimes occasion in himself the phenomenon of "pulse-breath" to a slight extent. But this observation upon one's self is somewhat obscured by the fact that any one, under such circumstances, can hear very plainly the sounds of his heart conducted to his ears through the solid structures of his body. In every case of tuberculized lung some portion of the lung must be more or less densified. To test whether mere densification of lung would occasion the phenomenon, I examined sixteen females and twenty males affected with phthisis in its less grave degrees. Some had small cavities, the majority had not; but all had morbid, moist sounds of some kind. "Pulse-breath" was not noticeable in any. To test whether the same would be the case if the circulation were excited, seventeen of the males obliged me by walking briskly for a mile and a half, and then again submitting to examination. Every variety of croak, wheeze, whistle and click, was to be heard when the patients held their mouths open, but in none the "pulse-breath." Three then ran until they were as much out of breath as seemed to be prudent, and were again examined, and with the same result. Hence, so far from tubercular densification of the lung, *pér se*, favouring the production of this sign, an amount of excited cardiac action which would

perhaps occasion "pulse-breath" when the lungs are healthy, fails to do so when the lung is tuberculized, at all events in the stage in which morbid, moist sounds exist. In a healthy person, the air-passages become drier after rapid exercise, and may so be rendered able to make sonorous vibrations upon the contained air in answer to the heart-stroke which is communicated to them through the blood which distends the over-filled pulmonic vessels. In the tuberculized lung there is less of vessel-capacity, and an amount of moisture in the air-passages which can effectually damp their vibrating sufficiently to affect the breath.

"Pulse-breath," then, appears to be due either to the impulse of the heart communicated directly to an empty pulmonic cavity, or to the same impulse conveyed through the blood-vessels to the air-cells and passages.

In the excavation variety, the essential conditions seem to be, that a cavity of sufficient size and firm walls shall be situated sufficiently near to the heart to receive its impulse directly; and that the cavity shall be sufficiently empty to throw the air which it contains into a sonorous pulse, which becomes audible if the mouth be kept open; just as an india-rubber bottle, with a tube in it, might be made to expel its contained air in rhythmical gushes if struck on the outside in a rhythmical order.

If this be so, the phenomenon will not be presented unless the cavity is sufficiently free from moist contents; and so far this corresponds with observation.

In the non-excavation variety, we have in the case before us (1) an enlarged, morbidly solid, and resistant liver, which, if it exercise any influence whatever in producing the phenomenon, can only do so by rendering the diaphragm a more unyielding floor to the thorax, and so favouring the production of pulmonary sounds. Probably it has no influence in the matter. (2.) We have an enlarged heart, of which, at every beat, the right ventricle is pushing blood forwards into the lungs, and the left ventricle through its regurgitant mitral orifice pushing blood backwards into the lungs. These

two forces, acting in opposite directions, meet at the same moment in the blood-vessels of the pulmonary air-cells and tubes, and intensify each other in the common result of making an impulse. Could we see what goes on, we should perceive that the pulmonary arteries pulsated, which is normal; and perhaps that the pulmonary veins pulsated too, which would be abnormal. In any case, the result of the habitual engorgement of the entire circle of pulmonic vessels is that either such a reflux pulsation from the left heart meets the onward pulsation from the right heart, or else that the congestion of the pulmonary veins so checks the circulation as to render the pulsation of the pulmonary arteries sufficiently manifest on the air-cells and tubes to produce a sonorous pulse in the air which they contain. (3.) We have an habitually distended condition of both auricles, which being augmented at each systole of the ventricles, may perhaps impart directly the impulse of the heart to the persistently densified upper lobe of the left lung, and by so doing occasion a vibration of the air contained in its tubes at the same instant of time as the pulse is communicated through the blood-vessels. Whether the existence of some such pulmonic condensation is essential to the production of the cardiac variety of "pulse-breath," I am not at present aware. The nature of the condensation in this instance is probably that it consists of some simple exudation, and of local hyperæmia, which relieves itself by the occasional hæmoptysis. There is no moist secretion in this or in any other part of the lungs, to "damp" the sound. It would be interesting to learn whether if the bronchial tubes became copiously moistened with secretion, the phenomenon would still be presented.

Although in each of the two varieties of "pulse-breath" both heart and lungs are concerned, yet the excavation variety may be designated pulmonary, and the other cardiac. The pulmonary variety will be occasional only, so long as the cavity on which it depends is sometimes full, sometimes empty. The cardiac variety will be constant, provided the

air-passages remain sufficiently dry. In each, the phenomenon will be intensified in proportion to extra-action of the heart.

I am not aware that the sign possesses any especial diagnostic or prognostic importance. When present, the nature of the case will probably, in every instance, be sufficiently evident without it. A case is barely supposable in which "pulse-breath" might be the first thing to attract attention in a person not previously known to have anything wrong in heart or lungs.

Amongst medical friends I have not met with any to whom the phenomenon above described was previously known. And I have not found any allusion to it in books.