

**Remarks on the diagnosis of some valvular diseases of the heart / by  
Andrew Anderson.**

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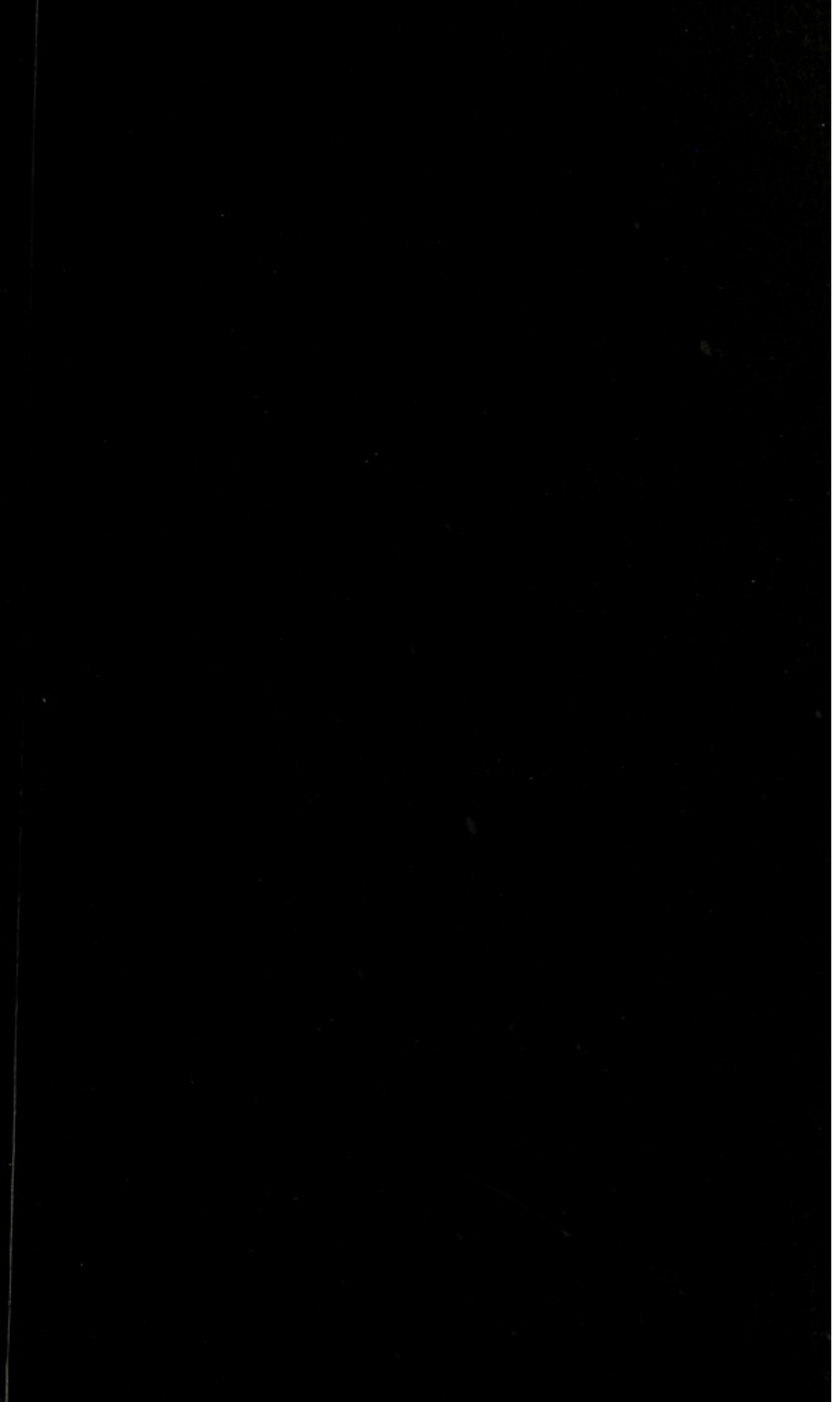
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## VALVULAR

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(Extracted)

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REMARKS  
ON THE  
DIAGNOSIS  
OF SOME  
VALVULAR DISEASES OF THE HEART.

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(Extracted from the *Lond. and Edin. Med. Jour.* for Feb. 1842.)

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THE following case appears to me to assist in explaining the cause of the first sound of the heart.

Margt. Gordon, aged 29, has for some years had occasional palpitations, which have latterly increased in frequency. There is much oppression, cough, and frequent paroxysms of orthopnoea; œdema of legs.

Percussion over heart natural; impulse weak. The sounds have quite changed character with one another, the first being short, quick, and abrupt, and followed by a pause; the second loud, and accompanied by a prolonged, coarse, rasping sound, audible only to the left side, and ending without interval in the next first sound. But for the coincidence with the impulse and arterial pulse, the latter would have been mistaken for the second, the other for the first sound.

*Inspection, ten days after report.*—Heart of natural size, right cavities healthy. Left auricle a good deal dilated, left ventricle natural bulk, small in capacity; in short, in the state which has been called concentric hypertrophy. Muscular substance firm; aorta and its valves natural. Mitral valve contracted, the centre of the membrane thin, though opaque; but its roots and edges, as well as the chordæ tendineæ, were stiff, cartilaginous, and

thickened. The aperture towards the ventricle was very small, yet easily closed by the cartilaginous valve; towards the auricle it was merely a slit an inch long and a quarter of an inch broad, rough and uneven, as well as stiffened, and exhibiting one small excrescence.

The *second* sound of the heart is on all hands allowed to coincide with the beginning of the ventricular diastole, and to be caused by the flapping of the arterial valves. The *first* is known to coincide with the ventricular systole, but not to depend on the blood, since it is found to be produced by the empty heart. It is probable that the *bruit musculaire* enters into its composition; but opinions are at variance as to whether the closure of the auriculo-ventricular valves is also concerned; I think the preceding observation renders it likely that it is.

If the first sound be supposed to depend chiefly or entirely on the closure of these valves, it is plain that in such a case as the present, where the valve is contracted, and the space through which it must move, in order to close, is small, that sound will be shortened, and the rest of the systole will take place in silence, there being no obstruction in the aortic orifice. In the natural state, these valves require some time to be floated up, under the guidance of the chordæ tendineæ. Here they had but one-eighth of an inch to pass through ere they met. Thus their action was reduced to a suddenness and shortness corresponding to that of the arterial valves, and the resulting sound simulated the natural snap of the second sound.

The abnormal pause after the shortened first sound occupied the time during which the blood was noiselessly flowing into the aorta, and the ventricle finishing its contraction. This period is usually occupied by the prolonged first sound. On the ventricular diastole the second sound occurred, for the aortic valves were healthy; but instead of the ventricle being rapidly and silently filled by the blood from the auricle passing through a free mitral opening, the obstruction presented by the extremely contracted state of that aperture occasioned this process to occupy a much longer time—to extend, in fact, over the period naturally devoted to the repose of the organ; while both during that time and during the immediately succeeding auricular systole, the blood flowed over a roughened passage, causing a loud rasping sound to be heard over the region of the affected valve.

The only lesion in this case, besides that of the mitral valve, was the concentric hypertrophy of the heart; and this might be supposed to have been the cause of the brevity of the first sound. But, setting aside the uncertainty which exists as to the real nature of this lesion, some pathologists attributing it to post-mortem change, the point is decided by the case of

Mrs Stewart, aged 26, admitted into the Glasgow Royal Infir-

mary, under the care of Dr. Anderson, in 1838. The impulse of the heart natural; the sounds weak and normal over the sternum and to the right side of that bone, but to the left presenting exactly the same characters as those described in the last case, except that there was less of a rasping character in the morbid sound. On inspection, the aortic valve was healthy, as well as the valves of the right heart; the mitral valve was contracted as described in the last case, but scarcely roughened. *The left ventricle was rather large.*

Reasoning from the above cases, it might be possible to arrange the sounds of the heart in valvular disease in a natural order, so as perhaps to facilitate the diagnosis of the different varieties of valvular disease, *depending on contraction*; for it has been shown, that when the mitral valve is widely and permanently patent, the sounds may be natural. (*Lancet*, Sept. 1841.) It ought also to be observed, that a simple bellows murmur, without a rasping or purring sound, is insufficient to prove the existence of valvular disease.

In the following observations I shall, for the sake of simplicity, speak of the valves of the left side only; it being of course understood that they apply to the more rarely occurring diseases of the right heart also.

The valvular diseases may be arranged as follows:—

1. Mitral valve contracted, but capable of closing.
2. .... incapable of closing.
3. Aortic valves contracted, capable of closing.
4. .... incapable of closing.
5. Combination of 2d and 4th cases.
6. .... 1st and 3d.
7. .... 1st and 4th.
8. .... 2d and 3d.

In all these, the *rhythm* of the systole and diastole of the cavities remains as in the healthy state; the flow of blood, and the sounds, being shortened or prolonged in consequence of the valvular disease.

The following table shows the mode in which these sounds are produced, and the modifications they undergo in each case.

	1	2	3	4	5	6	7	8
	Ventricular systole.				Ventricular diastole.		Rest.	Auricular systole.
Healthy state.	First sound.				Second sound.	Silence.		
1	First sound.	Silence.			Second sound.	Murmur.		
2	Murmur of regurgitation.				Second sound.	Murmur.		
3	First sound, masked by murmur.				Second sound.	Silence.		
4	First sound, masked by murmur.				Murmur of re-gurgitation.		Silence.	
5	Double murmur.						Single murmur.	
6	First sound, masked by murmur.	Murmur.			Second sound.	Murmur.		
7	First sound, masked by murmur.	Murmur.			Double murmur.		Single murmur.	
8	Double murmur.				Second sound.	Single murmur.		

If the time of one series of the heart's actions be divided into eight parts, the ventricular systole will occupy four, during which, in the healthy state, the first sound will be audible; the ventricular diastole two, the second sound occurring at its commencement. During the systole the blood flows into the aorta, and the mitral valve closes. During the diastole, the aortic valves having shut, the blood flows into the ventricle from the auricle. The action then ceases for one-eighth of the whole time, and the remaining one-eighth is occupied by the silent contraction of the auricles, the blood quietly flowing into the ventricles, and thus stimulating them to contract again. It is stated by the Committee of the British Association, that the systole of the auricles is accompanied by a sound; but if present, this is so slight, that in practice it may be disregarded. In the natural state then, we have a silence of one-fourth intervening *between the second and first sounds*, or before the latter.

## STATES OF DISEASE.

*1st Case.* The mitral valve shuts so rapidly, that the first sound is abbreviated, and the rest of the systole goes on in silence. Thus, the silence occurs *between the first and second sounds*, or after the former, as more fully described above, and as exemplified in the cases already related.

*2d Case.* The mitral valve never closes, nor is it ever fully open. There is no first sound, but a continuous murmur of regurgitation from the ventricle into the auricle during the ventricular systole. The second half period presents the same phenomena as in the last case. Example—in the papers in *The Lancet*, already quoted, there is a case of “double-dash murmur” recorded, accompanying both sounds of the heart, and found to depend on permanent patency, *i. e.* inability to close, in both auriculo-ventricular valves.

*3d Case.* The first sound is masked by a murmur caused by the blood passing into the aorta through the roughened and contracted orifice; but as the aortic valves close perfectly, and the heart is otherwise normal, the sounds, during the second half period, are as in the healthy state.

*4th Case.* The first half period as in the last case; but as the aortic valves will not close, there can be no second sound, its place being supplied by a murmur of regurgitation, caused by the blood passing back into the ventricle from the aorta through the patent valves. This lasts, however, only while the ventricle is dilating, since the blood flows into that cavity during the auricular systole over a healthy mitral valve. Hence there is silence during the last quarter period.

It is needless to give an example of the third case, as it is one of the most common varieties of valvular disease of the heart, and frequently met with. The following is an instance of case 4.

William Graham, aged 70. Anasarca and much dyspnœa; cardiac uneasiness; percussion dull over heart; impulse moderate; no abnormal sound heard except in cardiac region, where there is a slight bellows murmur and rasping with the first sound, and an obscure *souffle* accompanying the second, which has lost its natural sharp and abrupt character. Sinking.

*Inspection.*—Heart much enlarged, but no valvular disease except at orifice of aorta, the valves there being covered with verrucosities, and one of them completely contracted, so that, although the others were considerably enlarged, as if to supply its place, the aperture could not be closed, the aorta being slightly dilated.

The remaining cases are combinations of the others, and their sounds may be calculated from the comparison of the sounds proper to the individual lesions of which they are compounded.

I possess no observation of any but the 5th case. Elizabeth Taylor, aged 37. Has had heart affection, following on rheumatism, for many years; general dropsy and much dyspnœa; dulness to percussion, and strong purring tremor on the application of the hand over heart. The sounds are loud and natural above, but towards the left side are inaudible, a strong *bruit de scie* having replaced them, and, in the words of my report taken at the time, "apparently not referable to either of the sounds in particular, but seeming to belong to both." Died suddenly two days after report.

On inspection, pericardium was found to contain a good deal of fluid; auricles were much dilated, the ventricles of natural size; aortic valves projecting into the vessel, quite stiff, thickened, opaque, and cup-shaped; mitral valve completely cartilaginous, forming an immoveable ring, in the centre of which remained an elongated chink, incapable of altering its form.

This is a very good example of the only case in which both the sounds are really absent. Here, during the ventricular systole, there is the murmur of regurgitation from the blood flowing back into the auricle, through the patent mitral valve, and a direct murmur caused by the blood passing into the aorta over the roughened arterial orifice. This double sound is continued through the third quarter period, only with this difference, that the murmur of regurgitation is now caused by the blood flowing back from the aorta, and the direct murmur by the flow from the auricle. And in a similar manner, as may be seen from the table, the sounds in the other varieties of valvular disease may be explained. Of these, however, I possess no examples.

On the principles already laid down, we may perhaps venture to form the following classification of the diseases we have been considering.

A. SYSTOLE (VENTRICULAR) WITHOUT A MURMUR.

a. First sound natural. (The healthy state.)

b. First sound shortened, and followed by a pause.

(Case 1.) Here the second sound is long, and accompanied by a murmur.

B. SYSTOLE WITH A MURMUR.

a. *Diastole without a murmur.* (Case 3.) Here the second sound is natural.

b. *Diastole with a murmur*:—a continuous murmur during the whole action of heart.

a. Second sound present, being immediately followed by a murmur.

1. First sound absent.

a. Murmur with the systole single (Case 2.)

β. Murmur with the systole double (Case 8.)

2. First sound present, though short (Case 6.)

b. Second sound absent.

1. First sound absent. (Case 5.)

2. First sound present.

α. First sound continuing during the whole systole. (Case 7.)

β. First sound short, being followed by a period of silence. (Case 4.)

It may be concluded, that if either the systole or diastole of the ventricle be unaccompanied by a murmur, the disease present must be either case 1 or 3; in both which the valve is contracted, but capable of closing; and these cases can always be easily distinguished from one another, and from other varieties.

In all other cases there is a murmur accompanying both sounds; and here we have six varieties, distinguishable from each other with greater difficulty, in consequence of the distinction resting on the presence or absence of the sounds, which, even when present, are masked by the accompanying murmur, and therefore apt to be overlooked. As negative is always weaker than positive evidence, the 6th case is the only one of which we may be enabled to form a certain diagnosis, from distinctly ascertaining the presence of the sounds; and it may be observed that the lesion in this case is compounded of those in cases 1 and 3, which are both easily detected. The lesion in the remaining cases can only be suspected; but the second sound will, from its character, be always less easily masked than the first.

The diagnosis between cases 2 and 8 rests on the abnormal murmur being, during the systole, heard in the situation of both valves in one case, and over one only in the other; and this distinction may, in practice, be sometimes made. Hope states, and the cases I have related prove it, that the sounds depending on disease of the mitral valve are heard quite to the left inferior region of the chest; and the case of Mrs Stewart proves that we may have the sounds of the right heart perfectly normal over the sternum, and farther to the right, while those of the left heart are quite altered in character. In this case, the systole and diastole were coincident in both sides of the heart, though the sounds were different, except that the diastole, not completed in the usual short period, was prolonged into the 7th eighth of the action.

In the dead subject, the position of the heart is such, that the mitral valve is situated quite behind; and it might be supposed that a sound produced in that orifice would be obscurely heard. Experience contradicts this inference; and the explanation is to be found in an observation of Cruveilhier's on the heart of a monstrous fœtus, lately published in the British Journals; and the same fact results from the observations of Kaertschner (*Müller's Archiv.*, 1841,) that at the moment of contraction the heart is twisted on its axis, so as to bring the left cavities for-

wards. In the same paper Cruveilhier states, that there is no interval of rest in the heart's action, and that the auricular contraction does not antecede, nor cause, the ventricular systole; observations directly at variance with the most carefully performed experiments of other physiologists, and the less likely to be correct, that they were made on such a young and probably rapidly acting heart. He also delivers it as his opinion, that the first sound depends on the opening of the sigmoid valves; a conclusion which we must refuse to affirm, after perusing the cases of Mrs Gordon and Mrs Stewart already related; for in them the first sound was altered, while the only lesion was seated in the mitral valve. In obstruction of the aortic valve, a morbid sound accompanies the systole, as we have seen, and is heard upwards along the course of the aorta.

Should the above remarks be found to be based on correct reasoning, they may perhaps be found to facilitate the diagnosis of valvular disease.

