

Case of obstruction of the right auriculo-ventricular orifice / by W.T. Gairdner.

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CASE OF OBSTRUCTION OF THE RIGHT
AURICULO-VENTRICULAR ORIFICE.

By PROFESSOR W. T. GAIRDNER, M.D., LL.D., F.R.C.P.ED.



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Case of Obstruction of the Right Auriculo-Ventricular
Orifice, caused by a Tumour in the Auricle acting
as a Ball-Valve during the direct current from the
Auricle to the Ventricle, and without apparent
Disease of the Valve, or of the Heart otherwise.
Clinical Remarks on Diagnosis and Prognosis.
By Professor W. T. Gairdner, M.D., LL.D.,
F.R.C.P.Ed.

The extremely rare, if not absolutely unique, case here reported came under my notice during the life of the patient, in the Edinburgh Royal Infirmary in 1861. It was very carefully observed at that time, not only by myself, but by colleagues and others who were associated with me in the Infirmary, and also by not a few students and accidental visitors to the wards, who had heard of the case, being more or less specially interested in cardiac murmurs. It would not be a very unfair view of the matter to say that the patient was detained in the hospital for a considerable period as a "show case," the very unusual character of the phenomena being fully recognised, although the man all along declared himself quite able to work, and was not at all apparently suffering much from his disease. Perhaps it was owing to this notoriety of the case in 1861, and to the great importance attached to it in my *Clinical Medicine*, published in 1862,¹ that the late Dr. Greig of Dundee (where the patient resided and worked as a common labourer), was led to interest himself in the matter; and on the death of the patient from what is described as acute pneumonia, in April 1872, my late friend, though not otherwise connected with

¹ This volume having been for more than a quarter of a century out of print, the quotations from it in this paper may be justified on the ground of its not being readily accessible to many of the younger generation.

the case, was able to do for me, and for the whole art and science of medicine, the inestimable service of obtaining a post-mortem examination, which, but for his care and circumspection, would certainly have been neglected, and (as it was) only enabled him to remove the heart, and send it to me in Glasgow. Owing to various circumstances the case, although known to a not inconsiderable number of *experts*, and to many of my own students, has never been recorded in such a way as to be accessible, with proper illustrations, to the profession at large; and on this fact being represented to me by the promoters of the present undertaking, it seemed to them, as to me, a very fitting occasion for repairing past omissions in this respect. I have only to add now, by way of preface, that the case as now presented, with the excellent drawings kindly furnished by my colleague Professor Cleland, and Dr. T. W. Dewar, will tell its own story so well as to require but little commentary. I shall not even attempt, in this place, to deal, however slightly, with the literature of the subject, or to discuss at length the questions arising out of it. On one occasion, at a very crowded meeting of the Section of Medicine at the International Medical Congress in 1881, I exhibited the preparation here illustrated, and made some remarks on the clinical aspects of the case as already recorded; but, as I spoke in the belief that reporters were present (which proved not to be the case), the whole of the discussion which followed was practically lost, and I was so much discouraged by this accident, that the case remained unreported, and does not appear at all in the Transactions of the Congress. Notwithstanding this, the facts as then stated excited much interest among many of the leading pathologists and clinical teachers both of London and the Continent, who happened to be present; and some knowledge of these facts gained a wider circulation in this way. Even before this, Dr. Walshe had particularly referred to the case, on the basis of facts partly recorded, and partly supplied by me in correspondence.¹ More recently a brief account of it was given, in a series of cases of cardiac disease of long duration, to the meeting of the British Medical Association at Brighton in 1886;

¹ *Diseases of the Heart*, 4th ed. 1873, p. 375.

and the report of this¹ has formed the basis of a reference to the facts in the recent work of Dr. Sansom.² The preparation, which has for a long time formed a part of my private museum for class purposes, and has been demonstrated, since 1872, to many hundreds of students, with full verbal explanations of the clinical facts, has more recently been transferred to the Museum of the Western Infirmary, Glasgow, where it is still available for class demonstrations, but is perhaps more secure against accidental loss or injury, and more accessible to pathological inquirers generally. The present narrative will, I trust, afford the necessary data for future reference, both as to the clinical and pathological aspects of the case, in one continuous article; and although the precedence is of course due, in the order of time, to the clinical history, yet I think it will conduce to clear apprehension, and also to the strict impartiality of the narrative, if I give first the description furnished by Dr. Joseph Coats, as Curator of the Western Infirmary Museum, to the interleaved Catalogue of the Pathological Collection, Series II., 37A:—

“37A. OBSTRUCTION OF TRICUSPID ORIFICE BY TUMOUR IN
RIGHT AURICLE.

“A tumour of a globular shape, and about $1\frac{1}{2}$ in. in diameter, is attached by a narrow base to the posterior wall of the right auricle, immediately to the right of the opening of the inferior cava. From its attachment the tumour hangs down, so that its lower extremity is at the tricuspid orifice. The surface of the tumour is somewhat lobulated, and it is of a dense almost cartilaginous consistence. Under the microscope no organised structure is visible, merely an indefinite fibrous condition, with almost no cells or nuclei, and no proper connective tissue corpuscles. On the surface of the tumour there was found a more recent coagulum, which surmounted it and sent a process into the appendage. This is hung alongside the preparation. The heart is not appreciably enlarged or altered in any other way.”

¹ *British Medical Journal*, 5th Feb. 1887, p. 262.

² *The Diagnosis of the Diseases of the Heart and Aorta*, etc. 1892, p. 315.

The following is Professor Cleland's short description to accompany Plate III. :—

“The specimen shown me by Professor Gairdner from the Western Infirmary Collection (Series II. No. 37A), is a pedunculated vegetation, attached to the anterior or right end of the Eustachian valve. Other small vegetations occur on the auricular wall above the valve. The left half of the valve presents nodulated thickening. The annulus ovalis has disappeared, and the inter-auricular septum is thick, and the foramen ovale quite imperforate. There seems to be no evidence in the preparation to indicate whether the disease of the Eustachian valve dated from birth or prior to it, or from a later period.”

The reference to this case in my *Clinical Medicine*, p. 602, as mentioned above, is part of a discussion of the whole subject of cardiac murmurs, occupying Chapter 18 of that volume, followed by a report of a lecture, dated 28th February 1862, in which three months' entire experience of the different murmurs in hospital is summed up clinically, so as to show their relative frequency, and their most usual combinations, with a synopsis of all the cases referred to. At this time, it is to be remembered, the characteristic murmur of mitral obstruction, or stenosis, was by no means so well understood, or so generally admitted to be distinctive, as is now the case. It is, therefore, not without importance as regards the present narrative, that I was able to single out seven cases regarded as of mitral obstruction, with the auricular-systolic murmur, during the three months' hospital experience above referred to.¹ The opinion expressed as to these seven cases (some of which, however, had the murmur of regurgitation as well) was as follows :—“I feel as sure as I can well be of anything in medicine, that we have to do (in these seven cases) not only with mitral *disease*, but with mitral *obstruction*” (p. 599). But it is added : “In addition to these seven cases of mitral obstruction (two of which were of regurgitation also), there have been five other

¹ Of course it has to be admitted, and is hereby admitted, that I may have had rather more than an average number of these cases, owing to the interest I was well known to have taken in them.

cases of mitral regurgitation, having the V.S. murmur only. We cannot be sure that there is *not* obstruction in these cases; we can only be sure that there *is* regurgitation; there is no *evidence* of obstruction, but of course there may be obstruction without the characteristic murmur. . . . The regurgitation may, as I said before, be in some of these cases quite independent of any of the deformities of the valve; it may even occur without dilatation of the orifice. It may, in these circumstances, depend on a dilated ventricle, causing derangement of the mechanism by which the valve is closed in the normal condition" (p. 600).

In contrast or comparison with these statements as regards the mitral orifice, it is held (p. 601) that tricuspid murmurs are by no means rare (as was supposed by some), but "very apt to be confounded both with mitral and with exocardial murmurs; indeed, they are very frequently associated with mitral murmurs." The passage immediately following this (p. 602) affirms, however, that tricuspid murmurs (unlike mitral) *are almost always regurgitant, i.e. V.S. in rhythm*; and that they "very rarely proceed from deformity of the valve, but only from dilatation of the orifice or of the right ventricle, with secondary regurgitation. . . . The tricuspid murmur of obstruction (A.S.)¹ is among the rarest of clinical facts in my experience." It is at this point that reference is incidentally made to the case which is the subject of the present communication, not as one then under observation, but as constituting the rare exception which (according to the proverb) "proves the rule"; the absolute value of which, however, as a clinical observation, is enormously enhanced by the post-mortem examination made more than ten years later, and the results of which, so far as the heart is concerned, are set forth in this paper.

I propose, accordingly, to place before the reader all the essential clinical facts noted in this remarkable case in 1861, exactly in the words in which they were briefly noticed in my *Clinical Medicine* (pp. 602-604); and I may add, that

¹ It can scarcely be necessary at this late date, perhaps, to indicate the nomenclature adopted ever since 1861 by me, as characterising the rhythm of cardiac murmurs, viz. A.S., *auricular-systolic*; V.S., *ventricular-systolic*; V.D., *ventricular-diastolic*. See Finlayson's *Clinical Manual*, 3rd ed. 1891, p. 619, note.

although complicated cases, like those still more briefly indicated in the same paragraph, have occurred to me since, the case of Patrick M. is still the only one in my experience which could be cited in the terms used at the commencement of the following extract. The diagnosis moreover, as made in 1861, would have been *absolutely* correct, had the word *obstruction* been used (as in all the other passages referring to murmurs of A.S. rhythm) instead of *contraction*, employed in this particular instance. This one little *lapsus* may be, perhaps, condoned without much difficulty, if it is remembered that not one clinical or pathological expert among the crowded audience in London in 1881 professed to have seen or heard of a similar case; and rare as *contraction* of the tricuspid orifice occurring alone undoubtedly is, it is probably immensely less rare than the lesion displayed in the drawings of this case, and described so carefully and impartially by Dr. Coats and Professor Cleland.

"I have indeed heard, but once only, an A.S. murmur over the tricuspid orifice, absolutely uncomplicated, and free from the suspicion of mistake. The patient is an Irish labourer, Patrick M., æt. about 20, known to Dr. Greig of Dundee, where he is still living, and happily likely to live for some time. He suffers no very great amount of inconvenience from his disease, except from a very remarkable undulating movement in his neck, for which he came over to Edinburgh about two years ago, to consult Mr. Syme, supposing that it was something that might be cured by surgery. He afterwards came under my care, and remained a good while in my ward on two occasions, but more, I must confess, with a view to my scientific curiosity than to his own advantage, as there is little excuse for keeping him as an hospital patient.

"He is rather pallid, and perhaps not very strong, but of firmly-built frame, tolerably active, and neither livid nor dropsical. The undulation is beyond all question in the jugular veins on both sides of the neck; and it is quite evident that these veins are much dilated or enlarged permanently, without being much distended with their contents. The cardiac murmur begins immediately after the second sound; continues, *diminuendo*, throughout the pause, and then

goes on, *crescendo*, up to the first sound, at which it stops abruptly. I think tricuspid contraction may in this case be predicted with all but mathematical certainty; the fact, however, of having witnessed this typical instance, only serves to make me more entirely confident that I cannot have overlooked the fact in many other cases. In one other instance I must, and in yet another I may, have heard this murmur. In both these cases death occurred, and the hearts, now in my possession, and shown by me at the time to the Medico-Chirurgical Society, have a contracted tricuspid orifice, as part of a complex morbid condition of the valves. In one of them—Ann D., æt. 25, Register of Dissections, 9th August 1859—the murmur covered nearly every part, at some examinations quite every part, of the heart's sounds and their interval; and I thought I could distinguish the right side of the organ as being affected. In the other the murmur was quite unequivocally on the right side, but appeared to be a murmur of tricuspid regurgitation, which condition, no doubt, existed in addition to obstruction. This last was the case of the young girl, Mary P., æt. 11, mentioned at p. 97,¹ and I think there is good evidence that the disease began in the mitral orifice, and extended at a much later date to the tricuspid."

I now come to the circumstances attending my own receipt and first examination of the heart in this case, which were such as to give to this terminal scene of the narrative almost a dramatic interest in connection with what has been already set forth. Patrick M. lived for more than ten years after I first saw him, and died, as already stated, in April 1872. I had occasionally heard of him through Dr. Greig, but only in a very perfunctory fashion, as he was working, professing to be well in his health, and never presenting himself willingly, either for advice or treatment. Beyond this, I have no authentic information as to his later years, and

¹ The clinical estimate of this case, three years before, was as follows:—"She has, I think, a contracted mitral orifice; and with this there is associated, at present, a great deal of lividity, with feverishness, and marked prostration; the consequences, no doubt, of influenza (which was current at this time) acting upon organs predisposed to disease." She made a good recovery from these critical symptoms, but died later on.

none as to the details of his fatal illness, which was said to have been acute pneumonia. Indeed, both the beginning and the ending of the life-drama of this case may be said to be involved in mystery; but they are not less mysterious than the question which emerged and still emerges from it altogether, viz. How the active life of a common labourer could be tolerated for all these years under the conditions shown forth in the preparation? Of course, it must be admitted or assumed that the obstruction was incomplete, and that notwithstanding all the noise made in the passage of the blood from the right auricle into the ventricle, a nearly normal amount of blood must, in some way or another, have got past the obstacle at each diastolic and presystolic period. Had this not been so, the man must have got livid and dropsical, or even died by sheer cardiac suffocation, as in cases of embolism or thrombosis of the pulmonary artery. The remarkable thing, from the pathological as well as the clinical point of view, is that although in the dilated and leaping veins in the neck we have indubitable evidence of a back-wave, probably, I think, from the auricle (though no very exact observations were made on this point),¹ the auricle itself was not found after death to be very materially dilated or hypertrophied. In conformity with the general plan of this communication, however, I prefer to leave these facts without further commentary in the meantime.

To return to the incidents connected with the heart. The parcel containing it arrived from Dundee, without previous notice, and with a simple statement by Dr. Greig that it contained the heart of Patrick M., which he had been fortunate enough to be able to secure for me, the patient having died of acute pneumonia. I was engaged at the Royal Infirmary at the time, and surrounded by students, some of whom had probably heard of the case before. We adjourned, ac-

¹ I need scarcely say that at this time the graphic methods of Marey and others were but little known, and certainly had not been practised in Edinburgh. My own impressions, however (*quantum valeant*), founding upon previous observations made on the well-known case of congenital sternal fissure in M. Eugène Groux, were that the auricular pulse could be differentiated under favourable circumstances from the ventricular; and in this instance (according to the best of my recollection) I always held the venous pulse to be auricular. Dr. Sansom, I observe, has also adopted this view of it.

cordingly, to the Pathological Department, and there the parcel was opened after a short verbal statement as to the importance of the clinical facts, and the diagnosis to be verified on the lines given above. The heart, to my astonishment, looked externally very much like a healthy heart of moderate size, without any marked disproportion between its right and left sides, or between its auricular and ventricular cavities. On incising first the right ventricle, I felt with my finger for a ring of calcified stenosis, such as is so often found in the mitral orifice in the so-called "button-hole" form of contraction, or, alternately for a "funnel-shaped" stricture with the shortened and thickened *chordæ tendineæ* drawn to a point, as it were, midway in the ventricle. Nothing of the kind (I need not say) could be felt, and I had almost been led into raising the question, "What if there should be *no* obstruction after all?" "If by any chance this should be so, gentlemen," I said quite frankly to the bystanders, "we shall have to rewrite our whole cardiac diagnosis and pathology of murmurs; for it is impossible to find a stronger case than this for the *absolute* diagnosis of tricuspid obstruction." These words, or words to the like effect, had hardly been uttered, when, on passing my finger *beyond* the perfectly normal valve into the auricle, I at once encountered the bullet-shaped dense tumour so well depicted in Dr. Cleland's drawing (Plate III.), but rather more nearly in the position shown in Plate IV., though perhaps a little more receding from the lips of the valve. A very little more search with the finger, and afterwards a carefully devised incision of the auricle, now disclosed the real nature of the obstruction, and the astonishing fact that it must have been present in that situation *only* when the current was *towards* the ventricle, and must have been mechanically withdrawn from the orifice as soon as that current ceased to flow. In other words, we have to deal with *a case of tricuspid obstruction, which could only be obstructive during the diastolic and A.S. periods, and could by no possibility become the physical cause of a murmur of regurgitation.*

Now, observe what follows from this. A great deal of argumentative discussion has taken place within the last few

years as to whether the ordinary murmur of mitral stenosis (admitted to be distinctively such, even by those who differ from me as to its mode of production) is really *direct* or *regurgitant*. The discussion has been raised by eminent and excellent men, and in my small personal contribution to it I have fully recognised this fact. But, none the less, I may be permitted to say that to me, personally, the arguments for the latter view have appeared all along inconclusive, not to say wearisome and unprofitable, as being founded on a complete misapprehension of essential facts. One fact, of itself sufficient, has always seemed to me absolutely inconsistent with the theory of regurgitation as presented in the arguments alluded to. Regurgitation, as a cause of the pre-systolic, or (as I call it) A.S. murmur, must of necessity be limited to the mere instant of time when the valves are *in the act of closing or of tending to close*. This is not a mere academic distinction for argument's sake, but arises from the fact that regurgitation—to be such at all—must be closely tied to the ventricular systole and the outgoing current from the ventricles. But, as I carefully pointed out in 1861, the A.S.¹ murmur—or what I preferred to call such, for distinction—although markedly present, as a rule, during the period assigned to the normal auricular contraction, is not by any means limited to this period, but may extend backwards more or less into the pause, or even into the diastolic interval. Here is the passage referred to in my original sketch in 1861,² which almost innumerable observations since that time have amply confirmed as regards mitral stenosis, and which, as a mere statement of fact, has never been disputed.

“The auricular-systolic murmur may merely precede the first sound, *i.e.* it may follow the pause of the heart's action, or it may appear to be prolonged out of, or even quite through,

¹ This name was applied to it not, as several critics have supposed, because it was *produced by* the auricle in systole, but simply because the most characteristic element of the murmur—the so-called presystolic rhythm—was, in fact, *coincident in time* with the auricular systole. The name, therefore, involved no theory, but was simply the statement of a fact.

² Published first in the *Edinburgh Medical Journal* of that year, and reprinted in my *Clinical Medicine*, 1862, p. 575.

the period of rest, being in this last case necessarily associated with a degree of the ventricular-diastolic murmur, presently to be described. Its essential character, however, is preserved in every case as above defined, and as represented in the diagram."¹

In the present case of tricuspid obstruction, we have a murmur precisely of the character above described, but occurring under circumstances which render it impossible to suppose that there should have been any difficulty or delay in the closure of the valve, any more than in a normal heart. And even had there been regurgitation, the obstacle, not being fixed, but movable, would not have been in the way any more than the ball-valve of a syringe is in the way of the current generated by suction. Moreover, the murmur, covering as it did the entire diastolic, post-diastolic, and pre-systolic intervals, was quite unquestionably one and the same murmur throughout, only varying in its intensity without any sudden break or change of essential character. How, then, could any portion of it be reasonably held to be regurgitant? Now, in the average rumbling murmur of mitral stenosis, so familiar to all of us nowadays, precisely the same phenomena of rhythm may often be observed. It is more difficult, of course, to prove that there is *no* regurgitation² than in the case now reported, because the fact that the valves are diseased and the orifice permanently contracted, lends itself more easily to theories such as those which have been alleged, viz., that the murmur is not *pre-systolic* (as regards the ventricles), but occurs from reflux at the very beginning of

¹ This diagram, illustrating three different states of the murmur as described, will be found at p. 575 of my *Clinical Medicine*, and has been copied into Dr. Finlayson's *Clinical Manual*, 3rd ed. p. 620. It is one of a series long used in my class teaching, and employed in a lecture on "Modern Cardiac Pathology and Diagnosis," delivered in Edinburgh at the request of the Council of the Royal College of Physicians, in July 1861. As the facts are now so well known, and have never been controverted, it seems unnecessary to reproduce the diagram here.

² In point of fact there often *is* regurgitation, more or less, and when this is indicated by a murmur, I have pointed out that the murmur (V.S.) is entirely different, *i.e.* differs in its acoustic character, as well as in its rhythm, being quite sharply divided from the A.S. murmur by the first sound. No one who has ever got a firm and intelligent grip of these facts, now so familiar to most of us in Scotland, could possibly make the mistake of supposing that the A.S. murmur, as above described, and the V.S. which follows it, are in these cases *both* of them due to regurgitation.

the systole, due to the imperfect closure of the diseased valves. But the character of the murmur, its prolongation, and its covering, more or less completely, the diastolic period, are no less manifest in many cases of mitral stenosis than in the present case. And, accordingly, I have never had the slightest difficulty in my own mind in dismissing the *regurgitant* hypothesis of the A.S. murmur as wholly unsupported, and even plainly inconsistent with facts of quite ordinary occurrence, which every one may ascertain for himself.

One other consideration of practical importance and significance appears to arise out of the present case; and although I cannot hope here to develop fully what I have long thought, and taught, with respect to it, a few words in conclusion on the *prognosis of obstructive lesions in the A.V. orifices* may not be out of place. Many of the best writers on cardiac diseases have assumed, without attempting to prove, that mitral stenosis is of far graver prognosis than mitral regurgitation, and indeed that the former has the worst prognosis of all the commoner valvular lesions. This has always seemed to me an hypothetical or *à priori* conclusion, in no way justified by the facts of clinical experience. It is rather difficult, of course, to prove the opposite; and no one would wish, from taking up a merely controversial attitude, to appear to under-estimate the gravity of a stenosed mitral orifice. But it is quite safe to say that in no form of valvular lesion affording a sufficient basis of numbers for a general statement, can a larger proportion of instances be found of comfort maintained for years, and life prolonged almost indefinitely without the graver symptoms of heart disease. Absence of dropsy and cyanosis are so frequent as to be almost the rule in *simple* cases of mitral stenosis not complicated with marked dilatation of the right side of the heart; and very many of such cases, as they occur in practice, are not so complicated. One is often surprised at finding the murmur of mitral stenosis characteristically present in persons who can only by rigid questioning be brought to admit that they have any cardiac suffering at all; and in not a few of these the emphasis or reduplication of the second sound over the pulmonary artery shows

that undue tension in the pulmonic circulation is already present, though in some way or other so corrected or compensated as not to lead to serious accidents. A slight occasional hæmoptysis may occur at intervals, sometimes repeatedly, and over years, without necessarily leading up to more grave consequences. Perhaps, indeed, such small leakages, when observed apart from a tubercular history, are the most easily attainable facts from which the duration of a case of mitral stenosis can be inferred, in the absence of graver symptoms. I have known several instances of married women with large families, in whom mitral stenosis existed, and in whom it was impossible to infer anything directly as to the origin of the cardiac disorder, but that in a number of successive pregnancies, otherwise quite normal, such leakages of blood had occurred. I was tempted to infer in some of these instances that the cardiac lesion might have existed before marriage, or even during childhood. At all events, the mere occurrence of such cases at all must be taken as a very considerable set-off against the extremely unfavourable prognosis of this form of heart disease during pregnancy, as set forth in the late Dr. Angus Macdonald's well-known book.¹ I repeat that these statements are not to be taken as explaining away the real risks of mitral stenosis, which as regards secondary lesions in the heart itself, the lungs, kidneys, and brain, are simply incalculable. But they may at least serve to qualify the statements which have been made in the opposite direction; and to show that compensation, within limits, and under favourable circumstances, is not less possible in this than in aortic valve disease.²

The present case of tricuspid obstruction is an isolated one, and of too rare a kind to permit of any inference being founded on it, apart from the much more common case of the left A.V. orifice. But it seems to show that on

¹ *The Bearing of Chronic Disease of the Heart upon Pregnancy, Parturition, and Childbed.* By Angus Macdonald, M.D. London, 1878.

² I feel bound to refer particularly to a very able and interesting paper by my late clinical assistant, Dr. Middleton, now an acting physician in the Royal Infirmary, giving the results of a considerable amount of methodical observation of cases in the dispensary of that institution, and entitled, "A Contribution to the Study of Chronic Valvular Disease of the Heart, etc.," *Lancet*, 26th October and 2nd November 1889.

the right side of the heart also compensation, of a kind not to be expected *à priori*, may take place, to such an extent as to allow of more (probably *much* more) than ten years of the fairly active life of a common labourer being passed under the circumstances stated in this paper. These facts, which I stated verbally in London in 1881, have been adverted to constantly in my clinical teaching, and may probably have already tended somewhat to modify the extremely grave views entertained and expressed elsewhere as to the prognosis of mitral stenosis.

DESCRIPTION OF PLATES III. AND IV.

PLATE III.—View of the tumour, as seen when the right auricle has been everted artificially (and therefore altogether out of its natural position in reference to the auriculo-ventricular orifice), displaying fully the pedicle, and the attachment to the auricular endocardium, as described by Dr. Cleland, page 224. A much smaller concretion (probably of more recent formation) is seen attached just below the upper part of the auricular endocardium where it adjoins the appendix. The auriculo-ventricular opening is indicated by a piece of whalebone passed through it.

PLATE IV.—The tumour as seen from the ventricle, in its position of maximum descent into the auriculo-ventricular orifice, or as it may be supposed to have been placed during life by the action of the direct current during the auricular systole, when it gave rise to the A.S. murmur described.







