ON THE GREAT FREQUENCY
OF
CARDIAC MURMURS IN THE PUER-
PERAL STATE.

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(Received January 8rd—Read February 28th, 1882.)

THIS article is the outcome of a routine examination of the hearts of lying-in women. The opportunity for its production has been given me by the kindness of Dr. John Williams and Dr. Champneys.

The observations were made in the wards of the General Lying-in Hospital, Lambeth, and lasted over a period of six months, from February to August, 1881. The number of cases received during that term was 111; these were taken consecutively, not picked or selected. The kind and amount of examination has been of this sort. The women entered actually in labour, when a short present state was taken prior to delivery; their hearts were then investigated by the ordinary means at least once every morning during the time they were

resident in hospital, which was almost uniformly a fortnight; in addition to this, the visiting physician examined twice a week in the afternoon.

The chief result which this communication has to chronicle is the remarkable frequency with which murmurs were encountered over the præcordia of the ordinary hospital lying-in woman. I have good grounds for believing that these abnormal sounds occur outside the hospital in patients confined at their own homes.

Out of the 111 cases a murmur was heard in 84, or roughly about 75 per cent.

I have judged it best to tabulate the murmurs according to that part of the area of the præcordia over which they had their maximum intensity. Thus :

	1st sort.	2nd sort.	3rd sort.	Total.
Tricuspid. .	36	29		= 65
Pulmonary .	6	—	7	= 13
Mitral .	8	—	2	= 10
Aortic .	1	—	7	= 8 = 96

The murmurs are here arranged into three sorts; the apparent discrepancy between the result thus obtained and the former statement is due to the fact that cases were examined having more than one bruit.

It will be noticed that, contrary to what is met with in mixed practice, the seat of the majority of the murmurs is over what may be termed the right heart; so much is this the case that, instinctively after a time, one came to apply the stethoscope first to the left of the lower part of the sternum.

I shall now state, as summarily as possible, some facts which come out as the result of observation directed to the state of the heart's action and other features in these puerperal patients generally, before passing on to the subject proper of the bruits. An induction is made to the effect that what has been observed in these hundred and odd cases applies to all lying-in patients.

It is believed that in the puerperal state the right

heart is acting strongly. The pulmonary second sound was very commonly markedly accentuated, and it might be reduplicated and, sometimes very much changed in character, even to closely imitate, and, I believe, in a few cases actually to be a diastolic murmur. The first cardiac sound over the right ventricle also indicated robust action, and this sound was frequently reduplicated.

The colour of the conjunctivæ and mucous membranes has been recorded in every instance, and some investigations have been made with Dr. Gowers' modification of Hayem's hæmoglobinometer.

As was to be expected, a large proportion of the cases were paler than natural (67 per cent.); the average pallor in the language of the hæmoglobinometer was 70 to 85 per cent. of the normal colour standard. It has been considered that 90 per cent. is quite a metropolitan healthy standard. One multipara, living all her life in London, had cent. per cent. of hæmoglobin; this patient had a murmur of systolic time over the right ventricular, mitral, and pulmonary areas, of maximum intensity about the fourth left space, close to sternal edge; this murmur developed on the first day after delivery, and was heard for two mornings following, after which the first sound was altered in quality and slightly prolonged, but this feature disappeared, and the patient left the hospital with quite healthy sounds.

The urine was investigated daily in every case. The information thus gained has only a negative value; no accompanying change was made out between any of the characters of the urine and the occurrence of the murmurs. The urinary observations have their value in other ways.

The temperatures of the patients have been taken as systematically as possible every four hours. A fact of importance has come out in connection with this subject; it is that the bruit often had its intensity greatly augmented, and in some instances was only developed, and existed during a pyrexial period.

The occurrence of rheumatism in any of its protean aspects has been sought for in all the cases; the result is of negative value as regards the great bulk of the murmurs.

No one mark or set of marks in common seemed to exist, and there seemed to be no truly causational element in the factors of age, civil state, or number of pregnancies. We have broadly stated the numerical and positional strength of the murmurs; it is necessary now to make use of an appropriate arrangement in order to obtain further acquaintance with this vast and varied body.

Two cases of undoubtedly structural heart disease will be first separated; no further reference will be made to these. The great bulk of the murmurs remain to be dealt with. These murmurs may be divided by certain fairly well-marked characters into three kinds. Each of the three sorts will be fully treated of, both as to description and discussion of mechanism, before the next is considered, as tending to clearness of exposition.

The whole of the murmurs had one feature in common, that was their invariable systolic rhythm.

The First Sort of Murmur.

The first sort (resembling an ordinary endocardial murmur¹) was of blowing character, soft, usually low or medium pitched, fairly long, and heard with almost every cardiac stroke, presented but little variation during the whole course of its existence. The great majority of this kind were loudest over the right ventricular region, about the fourth left space and little to the left of left sternal edge.

They were thus distributed :

¹ Phrase used as conveying in two words a description.

<i>Seat of Maximum Intensity.</i>		<i>Conductibility.</i>	
Right Ventricular or Tricuspid . . . 36	{	Unconducted	15
		Heard all over the præcordia . . .	7
		„ over pulmonary	9
		„ „ „ and mitral	3
		„ „ „ „ aorta	1
Mitral 8	{	„ „ mitral	1=36
		Unconducted	3
		Heard over tricuspid	4
Pulmonary 6	{	„ all over the præcordia	1=8
		Unconducted	2
		Heard over tricuspid	2
Aortic 1	{	„ „ „ and mitral	2=6
		Heard also over pulmonary	1
		Total number of murmurs of 1st sort	=51

This is a summary view of what may be taken to be the varying conductibility of the murmurs having their maximum intensity over one or other of the four areas.

A murmur of this class was associated five times with one of the third class, three times with one of the second class.

This murmur possessed the most constancy; it was not, however, unimpeachably so. At times it altered its seat of maximum intensity, and at times even its existence might be called in question; the extent over which it could be heard varied even from day to day; it might even disappear so that nothing more than an impaired first sound could be said to exist, though there was no telling whether it would or would not return in all its former strength. No doubt this sounds fanciful, but that epithet belongs to the murmur, not to the observer. This murmur was rarely heard before delivery. Most commonly it developed during the next day or two following labour.

A notion which almost naturally suggests itself, seeing the frequency of the murmurs during the puerperal state, is whether these murmurs have such frequent presence during the pregnant state. In relation to this a satisfactory conclusion has not been come to.

Patients obtaining letters for the institution were examined once in the later months of pregnancy, and again on admission prior to delivery.

The tendency of these observations is to show that the bruits are by no means so frequent either during gestation or during labour as they are in the lying-in condition. Examination during a second stage labour-pain is obviously difficult and unsatisfactory in most cases.

In one case a murmur was distinctly heard and noted when the patient obtained her letter a month before confinement, but no murmur was made out during or at any time after labour.

It is probably true, but this is regarded quite as a tentative statement, that these murmurs are for the most part appanages of the puerperal state.

The duration of the murmur was very variable; supposing it to appear on the first or second day of childbed, it might last for two or three days or a week, or be heard up to and on the fourteenth day—the day of discharge. Twenty were heard when the patient was about to leave the hospital.

These cases should have been seen again at the end of a month, but, unfortunately, few returned.

Three of them were carefully examined after the month; in these no murmur was detected. Four retained their murmur, and these were obviously still anæmic, notwithstanding medicine. Of those who never had a murmur during childbed, some showed themselves at the end of the month and were then murmur free.

The first sound of the heart over the area, auscultation of which subsequently detected a murmur, was often markedly altered in quality and prolonged; and when it might be inferred that the murmur was disappearing this impurity of the first sound was again noticeable, the murmur being said not to exist, and yet the first sound still having or being accompanied with markedly changed features.

It is thought probable that the conditions originating

the first sound are variable, that the murmur is the furthest expression of this variation, an implication being that the whole or part of the antecedent or antecedents of the first sound may or can vary even in a short space of time.

Discussion of Mechanism.

Having described what has been observed and inferred with respect to this first sort of murmur, I may now pass on to the consideration of their mode of production.

The basic murmurs are regarded as of "hæmic" origin, without necessarily implying finality in our knowledge of these sounds.

The chief interest, it seems to me, fixes itself on the subject of the mechanism of the apical murmurs, and more especially of those seated over the right ventricle.

We have eight mitral murmurs to consider. Four of these are called permanent, as they existed from the beginning to the end of the case whilst under investigation.

None of the mitral murmurs were audible in the back of the patient, neither in the vertebral groove, nor at the inferior angle of the scapula.

Two permanent murmurs had a distinct history of rheumatic fever with joint affection; in these the apex beat and impulse observations indicated some hypertrophy.

Walshe says: "If the murmur be inaudible posteriorly, I believe it very seldom depends on regurgitation of structural mechanism; possibly it may never do so, but I am unprepared to adopt so sweeping a statement." Further, "Systolic apex murmur inaudible posteriorly is the exponent of dynamic mitral reflux or of various conditions, unnaturally soniferous, occurring in the interior of the ventricle." The "various conditions" mentioned in a tabular form by Walshe are "roughness of endocardium of ventricle or of inferior orifice of valve; mis-

attachment of a tendinous cord ; thickening and roughness of cords ; fibrinous threads crossing line of current ; coagula in cavity." Abnormal collision of blood is the mechanism assigned as producing the murmurs when these "various conditions" are present. The remaining two permanent bruits had no history of rheumatism. One was aged twenty-six and 2-para, the other aged thirty-six and 5-para: in both there were signs of hypertrophy. In all four the pulmonary second sound was markedly accentuated.

The four murmurs were probably dependent on some one of the "various conditions, unnaturally soniferous, occurring in the interior of the ventricle," an interesting element of this question being the possible origin (in two of the cases) of the murmur-producing mechanism during the pregnant and puerperal states. This subject is treated by Porak in his recent work. The four transitory murmurs must have had some equally transient antecedents.

The possibility of altered dynamic conditions being the *rationale* of these is favoured by recorded altered position of the apex beats in these cases whilst under observation¹ and by the known nervous instability of puerperal patients. Under this heading would come those murmurs heard in the mitral area not due to conduction, but being associated with a murmur elsewhere, yet holding a subordinate position, at least, in intensity. In one of the temporary mitral murmurs there was a history of rheumatic fever with joint affection.

The late Dr. Pearson Irvine advocated the mechanism of ventricular dilatation for murmurs occurring in chronic anæmia ; this explanation, with its molecular alteration of structure of the ventricular parietes, will not hold, I think, in the above cases.

The murmurs of maximum loudness over the right

¹ Errors in observation are apt to creep in. The callipers were used and the measurement taken from mid-line of sternum to apex beat. Allowance being made, I still think the observation really holds good, as the difference was from $\frac{1}{4}$ " at least to $\frac{1}{2}$ " at most.

ventricle are, to my mind the most interesting and the most novel.

I have been able to find only two papers which deal in any definite manner with murmurs of this situation. Parrot, in 1866, wrote an article on so-called anæmic murmurs, which he contended were produced at the tricuspid orifice, since they were loudest over the fourth left costal cartilage, there or thereabouts.

In the 'Archives de Tocologie' for March, 1881, Dr. Letulle has made out the existence of these sounds, though far less frequently, in childbed. His examinations were few, and so he missed a great number of these abnormal sounds. The murmur which Dr. Letulle described is sufficiently like the one I have endeavoured to pourtray to establish its identity. Dr. Letulle, like Parrot in the anæmic cases, regards the sound as indicating tricuspid regurgitation. He noted fulness and pulsation of jugular veins; increased transverse cardiac dulness pointing to dilatation of right heart.

I do not believe that the jugular pulsation exists apart and distinct from motion communicated by contiguous arteries. Moreover, in the presence of such vitiating and variable conditions of skin, fat, and breast, as may be met with in childbed, do I believe it possible to percuss to such niceties as Dr. Letulle evidently does.

In fact, to my mind, outside the existence of the systolic murmur, I do not think there is any sufficient evidence of tricuspid regurgitation.

That tricuspid back flow may take place, and be manifest to our senses only by a systolic murmur, or that it may occur with no outward sign, may be regarded as conceivable and perhaps possible.

Another suggestion may be made. Is it possible that these murmurs are really concerned with the outflow of blood from the right ventricle in its natural, rather than in its unnatural direction? That the murmur is direct rather than regurgitant.

The view that all these functional murmurs must be

produced at a cardiac orifice does seem to me rather unreasonable. Dr. Gowers has told me that he considers the notion that the murmur may originate in the ventricular cavity to be not at all an improbable one.

Physiology teaches us that during the progress of the systole the great arteries elongate as well as expand so as to put the base of the heart at a lower level. We also know from the same source that though this does occur, yet the apex beat remains stationary, this being due to the "gathering up" of the heart's muscular substance. The needle passed through the chest wall into the apex merely quivers, whilst that at the base moves upwards, indicating a downward dislocation. The tension in the pulmonary artery is, I believe, increased in the puerperal state, and so we might expect to find a lowering of the apex beat, continuing whilst the extra tension continued. Is it possible, therefore, that there is a migration of the pulmonary orifice downwards during the early part of child-bed? Would this be sufficient to explain the fact that these systolic murmurs have their greatest intensity as low as the fourth space? My observations will not bear straining to meet such a hypothesis.

I prefer to leave the question open: the *rationale* of murmurs is altogether too puzzling to be easily settled.

The Second Kind of Murmur.

This second sort (friction-like) was systolic in time, was almost absolutely non-conducted, being heard only over a very small area to the left of the median line of the sternum, it sounded quite superficial, and was short and high-pitched and rather stiff in quality. This friction-like systolic murmur was to be heard just above and to the left of the ensiform cartilage; it was usually audible only over an area which might be covered by the small end (of moderate size) of the stethoscope. The murmur was not to be heard with every cardiac beat; it

might be heard with a few strokes, then not for some beats, then might be once, and so on, with a variable appearance and disappearance. The whole duration of this sound was variable, differing in different cases, say from two days to three or more, mostly about a week, rarely audible up to and on day of discharge. In one case I was fortunate enough to be able to listen during a second stage labour pain, and then this murmur was noted to be constant with every cardiac stroke during that pain. If this observation be correct (and I was particularly struck with the absence of any vitiating circumstance), it seems to show that the bruit was in some manner in part at least dependent on a robust action of the right heart, the patient holding her breath during the pain. The seat of the murmur would about correspond to the "white patch" so often found on the right ventricle. I have no post-mortem evidence to offer on this point. My experience enables me to say that in all cases this murmur was a temporary phenomenon. The bruit was detected in 29 cases out of 111; it was the sole murmur in 22; it was associated six times with a murmur of the first sort; twice with one of the third sort.

I have stated my belief that the murmur is in some way related to a rubbing of the visceral over the parietal lamina of the pericardium, which laminæ may or may not be altered in some degree in structure.

Dr. John Williams and Dr. Champneys, I understand, were also of opinion that this sound owned an exocardial friction mechanism.

The arguments in favour of this view were its superficiality, its loudness, its limited area of audition and its high-pitched stiffish quality. None of these signs nor their combination is considered to be sufficient to diagnose exocardial sounds, for endocardial murmurs may undoubtedly possess these characters. A phase in the existence of this murmur in some cases was a curious "click-like" attendant on the true first sound of the

heart, this phrase used here by Dr. John Williams well expresses this occasional feature.

I am under the impression that this murmur has not been previously described in the puerperal state.

The Third Sort of Murmur.

In many respects this class is a heterogeneous one; but there is a sufficiency of common elements to warrant a grouping of the individual cases under one description. This murmur was remarkable for its loudness; its intensity was much greater than either of the others. In loudness the three murmurs may roughly be said to form a series. The first murmur may be likened to a constant galvanic current; the second to the shock of a slowly interrupted galvanic circuit; the third to the shock from a rapidly interrupted Faradic machine. They resemble these modes of electricity both in loudness and duration and in other points. This third sort of murmur was much more transitory than the second kind, and here again the serial graduation of the murmurs is remarked; so that the first sort was much more likely to be heard with every cardiac beat than the second, and the second than the third.

The duration or number of days on which the murmur was to be heard varied in like manner; speaking generally, the first sort was of longest course, the second sort next, and the third sort possessed least duration, being seldom heard for longer than three days.

These statements hold true in the main; they serve to convey as well as I am able in what way the murmurs differ from and resemble one another.

The murmur was heard 15 times out of 111; its site was very variable, but mostly basic; 2 were heard over the mitral area, 6 over the pulmonary, 6 over the aortic, 1 over both pulmonary and aortic. As a class, with only one or two exceptions, the area of audition of

this murmur was quite as limited as the murmur of the second kind. This was the murmur of all others which was mostly in relation with excited action of the heart due to pyrexia or mental emotion, or possibly other causes singly or combined. In several cases the murmur only existed when the temperature was raised, but this was not the case in all. In the most marked case of all the temperature was normal, but the patient was extremely pale, and had been so since a child. Besides pyrexia, excitement and anæmia, this murmur was very frequently associated with râles in the chest of medium size, and with a cough, but no sputa.

The quality of the sound evolved varied a good deal. In many the sound was very much like that elicited from scratching a piece of silk tightly held with the nail, or like the sound due to pressure on the carotid artery in anæmic cases, or like that heard in many cases of old phthisis over the apex of the lung where the subclavian artery is bound down by fibroid thickenings. In other cases the sibilant râle was almost exactly imitated; in one case the sound was like the sound of "crepitation," of dry and rather coarse characters.

What is the mechanism of these murmurs? All the murmurs were distinctly audible when the breathing was restrained; it seemed doubtful to me whether the varying amount of air in the chest exercised much influence on their production or intensity. Opinions were certainly divided as to their mode of generation. Perhaps this is the expression of the proper attitude to be adopted towards all questions relating to the genesis of any sound.

Dr. Champneys may have been right in some cases in supposing that the vigorously-acting heart was able with each stroke to force some air out of a pulmonary lobule or pulmonary lobules with sufficient force through a bronchiole constricted in some mode (probably from mucus, seeing the frequency of cough and râle in many cases) as to originate a sound of cardiac rhythm. Dr. John Williams may have been right in some cases in

supposing that they enjoyed a friction origin, but my inclination is to that standpoint that the murmurs were chiefly due to the blood condition plus the robust action of the heart, and I would here state my opinion that pyrexia may so alter the molecular structures in a short time as to render the production of sonorous vibrations remarkably easy. In two of the cases the rib cartilages were noted as quite yielding, and in these the murmur was, as regards its intensity, distinctly under the control of pressure through the stethoscope. One characteristic of this class must be again alluded to—important in any discussion of their mode of production—that was the extremely “capricious” mode of appearance and disappearance; this murmur was more “capricious” than either of the others.

The influence of posture on the production of all three kinds of murmur was early found out; it should be in every case the dorsal recumbent, arms to the side and head with shoulders “square.” This important point was fully known to earlier writers as Dr. Matthews Duncan informed me.

A knowledge of the occurrence and features of these murmurs will prove of great value for many reasons, of which only the chief can be mentioned here. It is right that we should be acquainted with their existence from the point of view of mere knowledge, even supposing that they had no other bearing.

I was called to a woman in child-bed out Kennington way, in my capacity of House Physician to the General Lying-in Hospital. The patient was ill, with severe abdominal pain and some fulness of abdomen, with thickly coated tongue; nothing pelvic apparently; had vomited; was inclined to be delirious; temperature 102° .

On listening over the præcordia, a murmur of my first sort, blowing, soft and medium pitched, was detected loudest about fourth left space close to sternum, conducted up to pulmonary base and outwards to left apex. There was no history of rheumatic fever; the patient had had seven

children, and had always enjoyed fair health. This case happened in early part of June, 1881. It would have been easy to have thought the case one of puerperal endocarditis. There was no albuminuria (catheter). The murmur was not found a week later; the patient made a good recovery.

Dr. John Williams related to me an almost similar case, in which his opinion was sought. This case was, no doubt, a murmur of the first sort. The medical attendant, an able practitioner, was distinctly under the impression that endocarditis had been set up. The murmur cleared up with the exception of a slight pulmonary systolic when I last heard of the case.

The patient recovered, but this is not the correct expression to use; the fact is that the majority of these patients know nothing about their hearts, this organ does not, as a rule, trouble them. In reality, it is the clinical physician rather than the patient who is apt to get alarmed at the presence of these murmurs. For this reason then, if for no other, I have thought it fitting to make my observations known.

The observations recorded in the early part as well as throughout this paper are valuable as tending to explain or be explained by the normal cardiac and circulatory conditions of the puerperal state. My observations lend support to those who consider that the tension in the pulmonary artery is increased in the early part of child-bed.

How that increased tension is brought about is quite another matter. Invocation of the reflex theory of nervous action would not be a difficult matter, and this theory would lend itself with much passive plasticity to explain the facts. It would be easy to say that contraction of the uterus causes, reflexly, contraction of pulmonary arterioles. Yet it would be extremely difficult to prove anything especially in such a complicated machine as the puerperal patient, where various and varying conditions vie with each other for recognition and a place.

Summary.

My chief conclusions may be stated in a few propositions:

Systolic murmurs are of very frequent occurrence over the præcordia of the lying-in woman (75 per cent.).

These murmurs are arranged into three sorts:

No. 1 is "endocardial-like," is conducted to a variable extent, may be heard over any part of the area of the præcordia.

No. 2 is "friction-like" and non-conducted, is of very constant site (just above and to *left* of xiphoid cartilage).

No. 3 is very loud, is of very curious quality, is very capricious, and non-conducted.

The most numerous of the first sort are loudest over the right ventricle *about* the fourth left space, close to the edge of the sternum.

The mechanism of this murmur is especially doubtful. The view of Letulle that the murmur represents tricuspid regurgitation is not supported by any facts beyond and outside of the presence of the systolic murmur.

The tension in the pulmonary artery is believed to be increased in the early part of child-bed.

The "right heart" is believed to be over-acting in the early part of child-bed.

These physiological factors of the puerperal state are intimately associated with the explanation of the abnormal sounds heard over the heart in child-bed. Special stress is laid on the fact that the great bulk of the murmurs are situate over the right heart.

The murmurs are for the most part not the expression of serious mischief; they are "functional" murmurs; the medical attendant need not be alarmed at their appearance in the great majority of cases.