and yet have ended fatally by the sudden bursting of an intra-thoracic aneurysm. In such cases the aid of the *x* rays is incalculable, as it converts the possibility of an intrathoracic tumour being the cause of the pain into a certainty.

This it did in my case, where it might be called a revelation, and it did more, for it told me that the tumour was a pulsating one, expanding laterally at each cardiac beat. Of this particular feature Dr. Watson assures me he is as certain as that the heart itself moves with each ventricular systole and diastole. By the use of the screen this is more readily made out, and indeed the print of the photograph (exhibited) shows it as an indistinct and hazy halo surrounding the tumour at its side.

POSTURE AND HEART MURMURS.

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VERY little attention has been directed to the influence of posture on heart murmurs. Murmurs are constantly being described and discussed without reference to the posture of the patient, the stray allusions in the textbooks (if we except the rather fuller treatment of "haemic" murmurs) are of the briefest sort, and statements so extreme as Potain's on "cardio-pulmonary" murmurs¹ are quoted without comment. The present position of the subject is thus summed up by Dr. Gee:

Some murmurs, which are audible whilst a patient is lying down, become much less loud or even disappear when he sits or stands. This is especially the case with mitral and tricuspid murmurs. The reason of the occurrence is not understood.²

I shall endeavour to show that the subject deserves more attention than has been bestowed upon it, and that there is an explanation of the phenomena which may be reasonably put forward.

If any one who has a considerable number of cardiac cases and cases of anaemia coming under his notice takes the trouble to examine these cases systematically both in the recumbent and sitting postures, he will find that change from one to the other position produces effects on the cardiac sounds which are generally obvious and sometimes profound. In making such observations there are several sources of error which have to be avoided.

Influence of Exertion.—To get rid of this the change of position must be effected by an assistant, so that no effort is made by the patient himself.

The Transitory Effect of the Change of Conditions.—A few pulse beats should be allowed to pass after changing the posture before listening again to the heart.

Possible Influence of Altered Adjustment of the Stethoscope.—The observations should be made with a straight wooden stethoscope.

"Cardio-pulmonary" Murmurs.—These should be excluded. Their dependence on respiration, their limitation to an area overlying the edge of the lung, and the fact that they do not follow the lines of conduction which characterize intracardiac murmurs should suffice to distinguish them. Potain's sweeping statement (that all murmurs which almost or altogether disappear when a change is made either from the sitting to the recumbent, or from the recumbent to the sitting posture are cardio-pulmonary) is not in accordance with the facts.

Having avoided these errors, it will be found that, although most murmurs are better heard when the patient lies down than when he sits up, this is by no means universal. There are murmurs which are uniformly influenced in the opposite direction, and there are murmurs in which position produces practically no effect. At first sight these differences seem merely bewildering, but on consideration it will, I think, be discovered that, instead of hindering, they actually help us to arrive at an explanation of the whole series of phenomena. In order to make this clear, I will briefly consider the effect of posture on each sort of murmur separately, confining the consideration to the commonest murmurs and to the two commonest positions, of sitting (or standing) and lying down.

A.—"HAEMIC" MURMURS.

1. *In the Pulmonary Area.*—The systolic murmur heard over the pulmonary artery is the murmur whose variations with

varying posture have been definitely insisted on. Dr. Sansom says it is "greatly influenced" by the position of the body, being louder as the patient returns to the recumbent posture.³ This murmur is often markedly increased by lying down, and a murmur may even be developed which was inaudible in the erect position. Moreover, the area of audibility may be greatly extended; a murmur which is heard over quite a small area while the patient sits may become audible over an area three or four times the size when she lies down.

2. *At the Apex.*—The systolic apical murmur is also greatly influenced by posture, both in loudness and area of audibility. Fig. 1 illustrates the increase in area.

Fig. 1.—E. B. Two "haemic" murmurs fusing on recumbency.

3. *In the Aortic Area.*—Fig. 1 also illustrates the fusion of two systolic "haemic" murmurs, one apical, the other "aortic," in consequence of each becoming audible over a wider area when the patient lies down. Fig. 2 similarly

Fig. 2.—Fusion of two "haemic" murmurs on recumbency.

illustrates the fusion of a "pulmonary" with an "aortic" haemic murmur.

4. *Venous Hum in the Neck.*—Although this is not a cardiac murmur it is necessary to refer to it here. It has been said

Fig. 3. E. D. Chlorosis. The venous hum vanished on recumbency. V, area of venous hum; H, area of "haemic" murmur.

to be "heard best in the standing position, being favoured by gravitation."⁴ In my experience it is often heard only in the standing position, being altogether lost on lying down. Fig. 3 represents the changes in the areas of venous hum and "haemic" murmur which were observed in a case where the hum was unusually widely heard.

B.—"ORGANIC" MURMURS.

1. *Mitral Regurgitation*.—The influence of posture is often pronounced in cases of recent murmurs developing in the course of chorea or acute rheumatism. These murmurs tend to be more evident when the patient is lying down. Fig. 4 is

Recumbent.

Fig. 4.—F. R. T. Systolic mitral murmur after rheumatic fever. The murmur was inaudible in the erect position.

taken from a case in which a systolic apical murmur conducted towards the left axilla, developed in the course of acute rheumatism. Posture also usually exerts the same influence on the systolic mitral murmurs of confirmed valvular disease, and of dilated auriculo-ventricular orifice, but apparently not so markedly as in recent valvular murmurs.

2. *Mitral Stenosis*.—Here just the reverse appears to obtain. The presystolic murmur of mitral stenosis tends to be louder and more widely heard when the patient sits up. The loudest mitral presystolic murmur I have heard was scarcely audible when the patient was recumbent. Fig. 5, taken from a case

Erect.

Recumbent.

Fig. 5.—O. C. Case of well-marked mitral disease, with slight aortic disease. There was a marked presystolic thrill. The presystolic murmur was clearly not "Flint's murmur." A, Area of aortic regurgitant murmur; B, area of mitral stenotic murmur; C, area of mitral regurgitant murmur. D, area of aortic stenotic murmur.

of marked mitral stenosis and slight aortic regurgitation, serves to illustrate the increase of area of the presystolic mitral murmur consequent on assuming the sitting position.

3. *Tricuspid Regurgitation*.—This murmur seems to me to be sometimes increased on lying down, but less so than is the murmur of mitral regurgitation. In the case from which Fig. 6 was taken I could detect no change, but in this case the pericardium was adherent. Some months previously, however, there was a very obvious increase on lying down.

4. *Aortic Regurgitation*.—Here posture has remarkably little effect. Sometimes recumbency seems to lessen the murmur a little, sometimes to increase it a little. The area of audibility

Erect and Recumbent. Area of Systolic Murmur.

Fig. 6.—F. T. Tricuspid regurgitation, with adherent pericardium and very extreme mitral stenosis. No mitral stenotic murmur was audible when this figure was traced. The tricuspid murmur had, some months earlier, been louder and more extensive on recumbency, being then audible almost all over an enlarged and pulsating liver.

remains about the same size, though it sometimes slightly shifts its position. See Figs. 5 and 7.

Erect.

Recumbent.

Fig. 7.—E. M. Aortic disease. The aortic regurgitant murmur was, if anything, rather fainter when she lay down. The aortic stenotic murmur was inaudible when she sat up. A, Area of aortic regurgitant murmur; B, area of aortic stenotic murmur.

5. *Aortic Stenosis*.—On the other hand, the murmur of aortic stenosis is often considerably increased by recumbency. See Figs. 5, 7, and 8.

Erect.

Recumbent.

Fig. 8.—H. D. Aortic stenosis. The shaded area indicates the maximum of the murmur. It became much louder on lying down.

SUMMARY OF EFFECTS OF RECUMBENCY.

In short, recumbency seems to tend to—

Increase	the murmurs of mitral regurgitation.	
"	"	tricuspid " (to a less degree)
"	"	aortic stenosis.
"	"	anaemia "pulmonary."
"	"	"apical."
"	"	"aortic."
Decrease	"	mitral stenosis and the venous hum of anaemia.
	Leaving unaffected	the murmur of aortic regurgitation.

Now, if these observations should, on more extended inquiry, prove to be illustrations of a general rule, how can they be explained? In trying to answer this question it is necessary at first to confine our consideration to the organic murmurs, because so much doubt exists as to the mode of origin of the "haemic" murmurs.

INFLUENCE OF CHANGE IN CHEST DEPTH.

It occurred to me, when looking for an explanation, that possibly the antero-posterior diameter of the chest might be less in the recumbent position than in the upright. I therefore measured several dozens of chests with a specially-designed pair of calipers, and I found that this was actually the case, and that the difference was even greater than I expected. Although a rigid chest may not differ at all in the two positions, a very elastic chest may be as much as one inch deeper antero-posteriorly, at the nipple level, in the upright position. The average difference between the antero-posterior diameters of the upright and recumbent chest at the nipple level seems to be half to three-quarters of an inch. This, at first sight, may not appear a great deal, but when we observe in sections of the human body, as in Braune's *Atlas*,⁵ that practically half of the antero-posterior diameter in the mid-line is formed by the solid structures of the back, the bony spine and the aorta and oesophagus, it will be obvious, in a chest measuring 7 inches from front to back in the upright position, where the reduction of half an inch is to be made not in 7 inches but in $3\frac{1}{2}$ inches, that this difference of half an inch becomes an important quantity. Moreover, it will be remembered that, of these $3\frac{1}{2}$ inches half an inch may be fairly taken to represent the sternum and its coverings. Consequently, the space which contains the heart becomes, in such a patient, on recumbency, shallower by about one-sixth of its depth. Such an alteration must bring the listening ear appreciably closer to the murmur-producing orifice.

Figs. 9 and 10, modified from Braune's sections, illustrate

Fig. 9.—Diagram of transverse section of the body at the base of the heart. (Modified from Braune). a, pulmonary artery; b, aorta; c, superior vena cava; d, sternum; e, vertebra.

the point and indicate the greater effect which slight reduction of depth will produce on murmurs at the pulmonary and aortic valves than on the tricuspid and mitral, the latter being more remote from the front of the chest. It ought to be most marked on murmurs at the pulmonary valves, which are nearest the front of the chest, and one knows that the shock of the valvular closure in an over-full pulmonary artery can sometimes be felt when the patient lies down, although it may not be felt when he stands up. The accentuated second

Fig. 10.—Diagram of transverse section of the body passing through heart. (Modified from Braune). a, mitral valve; b, tricuspid valve; c, sternum; d, vertebra.

pulmonary sound of mitral stenosis is also best heard when the patient is recumbent.

The change in chest depth on recumbency therefore should

greatly increase	a murmur at the pulmonary valves
decidedly "	" " aortic
somewhat "	" " tricuspid
" "	" " mitral

Here, therefore, we have probably part of the reason of the increase of some of the murmurs, although a further explanation is necessary, since in some rigid chests, where there is practically no change in chest depth on recumbency, re-

Fig. 11.—Diagram of the heart, seen from the front in the erect posture, showing the valvular orifices as they would probably appear in perspective if the heart were transparent. The arrows indicate the directions and inclinations to the vertical of the normal currents. a, mitral orifice; b, tricuspid orifice; c, aortic orifice; d, pulmonary orifice.

cumbency still influences cardiac murmurs. The clue to this further explanation lies, I think, in the relation of the venous hum to posture.

INFLUENCE OF GRAVITY.

Gravity (as Professor Clifford Allbutt has pointed out) seems to cause the increase of the hum in the upright position. Can gravity affect the murmurs in the heart? It seems so, and in order to illustrate the relation of the intracardiac blood currents to gravity, I have prepared Figs. 11 (p. 638) and

Fig. 12.—Diagram of the heart, seen from the left side in the recumbent posture, showing the valvular orifices, etc., as in Fig. 11. *a*, mitral orifice; *b*, tricuspid orifice; *c*, aortic orifice; *d*, pulmonary orifice.

Fig. 12, based chiefly on a careful consideration of the fine drawings in Professor Macalister's *Anatomy*, Professor Braune's *Atlas of Topographical Anatomy*, and Dr. Sibson's article in Reynolds's *System of Medicine*.

Fig. 11 is an attempt to represent the heart (as if transparent) seen with its valves in perspective from the front when the patient is upright. Fig. 12 is similarly an attempt to represent the heart and its valves from the left side when the patient is recumbent. Fig. 10, as just stated, is modified from a frozen section showing the arrangement of the heart cavities in the recumbent position.

From these diagrams it will be seen that :

In the upright position

Gravity should increase the force of flow
from left auricle to left ventricle
" aorta " "
And should decrease the force of flow
from left ventricle to left auricle
" right " " aorta
" left " " pulmonary artery
leaving almost unaffected the nearly horizontal flow between the
right cavities.

Whilst in the recumbent position

Gravity should increase the force of flow
from left ventricle to left auricle
" right " " right (to less degree)
" left " " aorta (slightly)
" right " " pulmonary artery
and should decrease the force of flow
from left auricle to left ventricle
" aorta " " (slightly)
In short recumbency, owing to the action of gravity, should
increase the force of the flow of mitral regurgitation
" " " " tricuspid " (to less degree)
" " " " aortic stenosis
" " " " pulmonary stenosis
and decrease the force of flow of mitral stenosis and
" " " " aortic regurgitation.

In other words, since whatever tends to reduce the force of flow through the valves tends to lessen the murmurs produced at them, and whatever tends to increase the force of flow tends to augment the murmurs, the action of gravity alone appears to explain all the peculiarities observed, except that it does not reduce the murmur of aortic regurgitation.

In the case of aortic regurgitation, however, the force producing the regurgitation is an exceptionally great one—the aortic tension—and in the case of the aortic valves we have the effect of chest depth directly opposed to the effect of gravity.

Taking, then, change of chest depth and gravity together, we should expect to find on recumbency :

Mitral regurgitant murmurs increased,
Mitral stenotic murmurs decreased.
Tricuspid regurgitant murmurs increased.
Aortic stenotic murmurs increased.
Aortic regurgitant murmurs scarcely, if at all, affected.

And these are just the effects which appear to be produced.

Turning next to "haemic" murmurs, it is curious to observe that (assuming the foregoing to be generally true) these behave exactly as if they were produced at the valves to which they correspond. If the apical "haemic" murmur is (as is generally admitted) a real mitral regurgitation, if the pulmonary "haemic" murmur is (as is often denied) a real pulmonary "forward" murmur, and if the aortic "haemic" murmur (which is scarcely discussed) is a real aortic "forward" murmur, we ought to find on recumbency :

The pulmonary murmur greatly increased.
The aortic " " increased.
The mitral " " "

And this is exactly what we do find.

There is an explanation of the pulmonary "haemic" murmur which, so far as I know, has never been put forward, yet may perhaps deserve consideration—namely, that whilst the normal right ventricle, throwing the normal amount of blood into the pulmonary artery, flings wide the valves, and thus encounters no constriction, in anaemia a relaxed right ventricle, propelling a reduced amount of blood, may fail to force quite open the pulmonary valves, and then these valves, though healthy, being held by the pulmonary tension in an intermediate position, may actually, by their position, constitute a constriction and produce a murmur. If this be so, then the explanation of the changes in the murmurs due to change of posture would seem to be complete.

If gravity really exercises the influence which I believe it does, a number of interesting questions arise. To take one instance: we may ask, Does a patient in the last stage of mitral regurgitation assume a forward-leaning position when trying to sleep, in order to bring gravity as much as possible to his assistance, that object being certainly thus attained?

SUMMARY.

1. It seems to me that recumbency tends to increase all "haemic" murmurs except the venous hum, which it tends to obliterate; to increase the murmurs of mitral regurgitation, tricuspid regurgitation, and aortic stenosis; to decrease the murmur of mitral stenosis, and to leave little, if at all, affected the murmur of aortic regurgitation.
2. That the effects of gravity and of change in chest-depth seem to account for the influence of recumbency.
3. And that, therefore, in describing and discussing murmurs which posture modifies the patient's position at the time of observation should be stated.

REFERENCES.

¹ Potain, *Clinique Médicale de la Charité*, quoted by Sansom in Allbutt's *System of Medicine*, vol. v, p. 979. ² Gee, *Auscultation and Percussion*, 1893 edition, p. 149. ³ Allbutt's *System of Medicine*, vol. v, p. 504. ⁴ Allbutt's *System of Medicine*, vol. v, p. 502. ⁵ Braune, *An Atlas of Topographical Anatomy*, translated by Edward Bellamy.

TWO CASES OF CONGENITAL DISEASE OF THE LEFT SIDE OF THE HEART.*

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ALTHOUGH it has frequently been suggested that cases of valvular disease of the left side of the heart may date from fetal life, there has been little *post-mortem* evidence in favour of such a view. Dr. Goodhart once remarked that he had hunted for years for a specimen of mitral stenosis in an infant, both in the *post-mortem* room and in museums, but had not succeeded in finding one. Neither had he met with any medical man who had seen such a specimen.¹ The two following cases illustrate the fact that congenital disease of the left side of the heart may exist, but it does not follow that there is any foundation for the theory that a valvular lesion

* The specimens from these two cases were shown before the Society for the Study of Disease in Children.