V.—uterine rotation: its clinical importance in pregnancy and labour.

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It is nearly four years ago since I had the honour of reading a paper to this society on a variety of post-partum shock, some cases of which had come under my notice. I ascribed the occurrence of the shock to bruising of the ovaries during the application of the Crede method in the third stage of labour, and stated my belief that owing to the frequent occurrence of uterine rotation in pregnancy, the ovaries are so situated as to be not uncommonly in danger of injurious compression during the expression of the placenta, and that this compression might produce alarming reflex manifestations.

With increasing experience I have grown even more confident of the very frequent occurrence of this uterine rotation, in the third stage of labour especially. Its amount varies in degree in different patients, but in the vast proportion of cases its existence is distinctly to be observed, and its amount easily appreciated. For a record of my previous cases vide Edinburgh Medical Journal, July 1889. See also similar cases recorded by Graham, British Medical Journal, May 1891, and by Newell.

I propose to-night to adduce some additional facts in support of my contention, as in my former paper I did little more than relate the cases and briefly state the conclusions at which I had arrived.

During the last three years I have received many voluntary and unsolicited corroborations of the truth of what I then stated, from medical practitioners whose clinical experience tallied with my own.

Recently Dr Webster, from a study of post-mortem and frozen sections, has stated that frozen sections do not support the statement that the uterus is rotated, and he further states that the method of frozen sections is a sure method, implying that its results must be absolutely correct. Now, against this assertion I feel bound to enter a protest. I agree with Fritsch when he says that "The position of the female genital organs in a living woman can only be determined by the examination of a living woman, and that post-mortem sections, whether frozen or not, are never capable by themselves of giving a decision as to their position in the living subject." On the other hand, I quite admit that examination of the living subject is, of course, always liable to error, and one can never claim for it absolute accuracy, owing to the impossibility of
getting directly at the uterus, and the varying degrees of skill of different examiners.

Of this, however, I am sure, that rotation of the uterus, especially in the third stage of labour and immediately post-partum, can be better observed clinically than after death; and owing to the special facilities existing then, one can claim for one's clinical examination a very fair degree of accuracy, perhaps greater than under any other circumstances.

Rotation is to a great extent a vital property of the uterus; it tends to disappear when muscular contraction ceases, and to become undone by post-mortem gravitation. The greater the muscular contraction and retraction, the more marked (ceteris paribus) is the rotation. Such vital processes are apt to be overlooked in the conclusions which are drawn from the examination of frozen sections alone, and consequently the results of patient anatomical work often lose much of their practical importance. Take as an illustration the position of the apex-beat of the heart. If one were guided by post-mortem evidence alone, one would be led considerably astray. One would imagine it to be produced, as Vierordt shows, by the tip of the right ventricle, and to be further from the middle line than it is; whereas, as a result of a movement of rotation occurring during each systole, the apex of the left ventricle comes to the front and impinges on the chest-wall at a spot nearer the middle line.

The minute and careful descriptions of post-mortem frozen sections are interesting enough in their way, and have no doubt done a great deal to open up and elucidate much that is of importance as regards the relationships of parts which are more or less rigid or incarcerated, and whose position is not much affected by death, and post-mortem changes, especially and notably,—for example, advanced pregnancy, the two first stages of labour, and certain cases of extra-uterine gestation. They are, however, of no practical value whatever in alone determining the exact position of a freely movable organ, such as the body and fundus of the uterus, which even in life is affected by every movement of the body, and whose attitude, especially after labour, is to a great extent dependent on muscular vitality and tonicity. Especially does this hold good in the determination of the position of the unimpregnated uterus, the uterus in early pregnancy, and the uterus in the third stage of labour and post-partum. For in these circumstances the uterus is freely movable, not being unduly large, and consequently comparatively little influenced by outside pressure apart from the general abdominal pressure.

Webster found that in all his cases the walls of the uterus were bloodless, showing that strong muscular contraction had at one time existed. In frozen sections the post-partum uterus resembles a molluscan plastic mass, totally different to the impression it
gives one clinically in the early puerperium of a firm, hard coherent body, with a definite shape and outline which can be easily recognised. The difference is simply that between life and death. The post-mortem uterus has lost none of its material constituents, but it has lost that subtle and mysterious thing called life, that which gave it form and vigour, and without which it is but a piece of inert matter dependent for its form and position on accidental circumstances. It is probable, however, that owing to the muscular degeneration and progressive absorption which takes place during involution, that uterine rotation becomes less distinct as the puerperium advances and muscular contraction ceases.

For these reasons I do not think we are justified in assuming that the position or relations of the puerperal uterus can at all satisfactorily be determined by post-mortem examination alone. The conclusions of such methods are certainly misleading, and are productive of no practical results.

I. Position of the Uterus.

(a.) Unimpregnated.—It is now clearly established that the uterus, in addition to its inclination forwards, and its usual deviation to the right side, is rotated on its longitudinal axis in the vast majority of cases in such a way as to bring its left border forwards. This rotation, which occurs in the unimpregnated condition, and which has been described by Rouget, Claudius, Krause, His, Lusk, Spiegelberg, Martin, and others, becomes much more marked in the pregnant condition. According to Dohrn, Spiegelberg, and Olshausen, this rotation is caused mainly by the pressure of the rectum, during development, pressing on the left side. Pfannkuch quotes Thiersch, who says that Müller's ducts often lie obliquely or perpendicularly to one another in embryonic sheep, and Dohrn says that in sheep, cattle, and human embryos the left duct usually lies further forward than the right. Pfannkuch says, "The inclination of the fundus to the right with rotation of the left edge forwards is a position which has already shown itself in foetal life, and as regards essentials is to be traced back to the first development of the foetal intestines." Spiegelberg thinks the weight of the uterus in the right lateral posture (which is the commoner) is another potent cause.

(b.) During pregnancy the rotation to the right on the longitudinal axis becomes still more evident, and, according to Chaignot, Charpentier, and others, is more marked during the last month. Schroeder, Stratz, Freund, Olshausen, and E. Martin have established this beyond the possibility of a doubt, and Charpentier, Spiegelberg, Kölliker, Lusk, Rouget, Bayer, Küstner, Winter, Tarnier, Claudius, Croom, Krause, and others all describe this marked rotation. Depaul remarks that in a pregnant uterus "Rotation is a fact which has been confirmed by numerous necropsies." Croom has noted in many cases that in pregnancy the anterior surface of
the uterus looks to the right, so that the transverse axis of the fundus is in the right oblique diameter of the pelvis. Schroeder and Stratz, in a frozen section made on the body of a woman in labour at the beginning of the first stage, describe the uterus as deviating so much from the symmetrical position that its left border was turned forwards and downwards, its right border backwards and upwards. Winter also describes a frozen section which he made, in which the pregnant uterus lay exactly in the middle line with its left edge forwards. In another section which he made the bowels were enormously distended with gas, and he did not look for rotation. Few observers seem to have done so.

In certain animals—the cow, for instance—this uterine rotation is greatly exaggerated. Sometimes it takes place to such an extent as to twist the vagina secondarily upon itself, and so create a serious source of dystocia (Auvard, Charpentier). Dolèris, quoted by Charpentier, has observed a case where rotation was so great in a pregnant woman that there were “phénomènes d'obstruction graves” during the labour. This was due to a semi-pathological condition associated with abnormal relaxation of the pelvic tissues. The rotation in this case, strangely enough, was to the left.

A great many causes have been adduced to account for this rotation.

Spiegelberg thinks it depends mainly on an inherited tendency, but that it is increased by the small depth the abdominal cavity offers in the middle line, owing to the prominent spinal column, as well as by the force of gravity in consequence of most pregnant women lying on their right side.

E. Martin says that often in Cæsarean section, where lordosis was present, the uterus was so excessively rotated that its left border lay in the middle line anteriorly.

Schroeder and Stratz believe, from clinical observation as well as frozen sections, that this rotation of the uterus in pregnancy is due to the position of the child in utero. That side of the uterus which corresponds to the back of the child is always rotated forwards. They describe the breech as coming sideways out of the body of the uterus, the corresponding border of the uterus as turned forwards, and the corresponding ligamentum rotundum as being more tightly drawn, while the fundus sinks over to the opposite side. This they regard as the normal process. They further say, “If we regard the usual first position of the head, which is so frequent, we observe that while the ring of contraction moves upwards upon the child, the fundus inclines somewhat to the right, i.e., to the side of the abdomen of the child. This is easy to recognise by the stronger tension of the left round ligament, because it is inserted higher than the right one. The left round ligament is clearly to be felt somewhat to the left of the median line, while the right is only to be felt sideways with difficulty.”
In observations of 120 head positions, they found that in 102 the ligamentum rotundum, which corresponded to the back of the child, was rotated forwards. In other 15 cases it turned forwards after the emptying of the bladder, and only in three cases was the tension of the round ligaments the same on both sides, and in these three cases the breech went straight out forwards, while the fundus sank backwards. In no single case could they observe that the round ligament corresponding to the abdomen of the child lay forwards.

I cannot agree with Schroeder and Stratz in ascribing the rotation of the uterus to the position of the foetus in utero. I am inclined to agree with Spiegelberg's views so far, but I think there are other causes which deserve to be brought forward.

The first is the traction exercised by the round ligaments. An important point to be remembered (which has been pointed out by Joulin, Depaul, Tarnier, and Chantreuil) is that the insertions of the round ligaments and of the tubes are found on the fully pregnant uterus nearly at the union of the anterior third with the posterior thirds of the organ. Stoltz has found that the round ligaments are quadrupled in size during pregnancy, and he finds that the right round ligament is shorter and thicker than the left. Schroeder and Stratz have proved that the left round ligament is inserted higher on the uterus than the right, and is therefore more tensely stretched. Homburger finds the left ligamentum rotundum usually more distinct and larger than the right, and that the right one is only to be felt rarely when the uterus is rotated to the left. The more tensely stretched left round ligament will thus tend to increase rotation by pulling the left border of the uterus forwards.

Another cause is one which I believe acts chiefly in the early months of pregnancy, and that is the asymmetry of the bladder when it is distended. The full bladder bulges to the right side; it will thus push back the right border of the uterus, and the loaded rectum will push forward the left border. These latter influences, as I have said, can only act on the pregnant uterus while it is yet a pelvic organ, but at any rate they will help to give it a "set" in the direction I have indicated. When Resident Physician in the Royal Maternity Hospital here, I conducted a series of twenty observations on distended bladders in pregnancy, and found that in every case a flexible bougie introduced into the bladder passed distinctly to the right side, thus proving that the greatest distention of the bladder was in that direction.

Yet another cause of the rotation of the pregnant uterus is one which I consider to be a most potent one, and it is to be looked for in the disposition and arrangement of the middle layer of the muscular fibres of the uterus. I would call this an intrinsic cause of rotation as opposed to the extrinsic causes just considered. These muscular fibres run obliquely in all
directions, and it is impossible to conceive that their influence can be equal on both sides. The uterus in this respect may be compared to the heart. The heart is fixed at its base at its junction with the aorta, and at every ventricular systole it rotates on its longitudinal axis to the right, so that the left ventricle comes more forward. The uterus is likewise fixed partly by the ligaments in the pelvic cavity, and partly by its insertion into the vagina. The fundus would correspond to the apex of the heart.

As the muscular fibres develop in pregnancy, they in all probability tend to increase the rotation to the right, by being brought into play actively in the intermittent uterine contractions which are known to exist all through pregnancy; and passively, owing to the stretching which the uterine walls then undergo through the development of the foetus. To illustrate the effects of distention: take a fresh bladder, fix it below, and distend it moderately with water; we shall find that the bladder rotates on its longitudinal axis, and the greater the distention up to a certain point the more marked will be the rotation. The same thing occurs in the uterus when its walls become distended by the rapid growth of its contents during pregnancy, the oblique muscular fibres being stretched and passively helping to increase the rotation of the organ. I have only assumed so far that the arrangement of the muscular fibres in the uterus is such as to bring this about; but Auvard confirms the truth of my assumption, as he has shown that the development of the uterus is rarely perfectly symmetrical. He has shown, in following the development of the pregnant uterus, that the symmetrical development of the two halves of the organ produced a uterus which seemed median, while the asymmetrical development seemed to give a right or left inclination, as the case may be. The right development is by far the most common, and any real deviation is simply secondary to that due to greater development.

The anterior surface of the uterus is usually inclined towards the side on which the organ is most developed. In this way the more voluminous horn seems to draw after it the corresponding side of the gestating organ back towards the vertebral column, withdrawing the broad ligament from the same side of the abdominal wall, and acting conversely on the other broad ligament. This explains clearly why rotation becomes more marked during labour and in the early puerperium, the muscular fibres being then in a state of great activity.

The unequal development of different parts of the uterus in pregnancy is further confirmed by Joulin, who says that the increase during the first months is chiefly in the direction of the transverse and antero-posterior diameters, and by Tarnier and Chantreuil, who state that the fundus of the organ increases considerably during the first six months, and the lateral parts follow this increase unequally. The inferior part develops chiefly during
the three last months, and is usually more dilated anteriorly than posteriorly, the posterior part of the body being that which develops most in the upper two-thirds.

**Frequency of Right Lateral Rotation of the Uterus, and its Relation to the Position of the Child.**

Instead of ascribing the rotation of the uterus to the position of the child, as do Schroeder and Stratz, I believe with Lusk, Spiegelberg, and E. Martin, that the position of the child is probably influenced by the rotation of the uterus. Bayer is of opinion that owing to the traction exercised by, and the kind of hypertrophy of, the muscular fibres, the shape and appearance of the uterus are much influenced in the later months of pregnancy by the growth of the foetus. This can only be so, however, in the later months.

I am far from doubting the accuracy of Schroeder's and Stratz's observations, for I am convinced that they correctly represent the usual state of matters. In their theory as to the production of the rotation, however, they confound cause with effect; for it is not the position of the foetus in utero which causes the rotation, but it is the rotation which to a great extent influences the position. It is possible that the foetus during the last month of pregnancy may help by its position to increase the already existing rotation, and so make it more marked. We are able, therefore, to ascertain approximately the frequency of the occurrence of right lateral rotation of the uterus by considering the position of the child, which is so much influenced by the rotation. We argue from the effect caused to the cause itself. If we allow that the position of the child is caused by the rotation, then the demonstration of the frequency of the occurrence of the position will give the frequency of occurrence of the rotation. When the uterus is rotated on its longitudinal axis to the right, the transverse axis of the uterus lies diagonally in the pelvis in the right oblique diameter. This to a great extent accounts for the fact that in cranial presentations (which constitute fully 95 per cent. of all labours) the vertex of the foetal head lies, in 99 per cent., in the right oblique diameter of the pelvis. According to Spiegelberg, the back of the child in vertex presentations is directed to the left and forwards in 70 per cent. of cases, and to the right in 30 per cent. When it is directed to the right it is most usually inclined backwards. Although Schroeder and Stratz argue erroneously from their premisses, and confound cause with effect, yet their statistics are sufficiently reliable to be accepted with confidence. They found that out of 120 head presentations which they examined, the uterus was rotated in 117,—in other words, in 97.6 per cent. They do not definitely state whether rotation was right or left, but say that the border of the uterus corresponding to the foetal back was always
turned forwards. Counting only (by general statistics) those cases where the back was forward and to the left, this would give 84 left occipito-anterior positions out of those 120 cases as the very lowest computation,—in other words, Spiegelberg's 70 per cent. But from my own observations I am distinctly of opinion that right lateral rotation of the uterus also occurs in right occipito-posterior positions, though perhaps not quite so constantly as in left occipito-anterior cases. Such being the case, the percentage of cases of right lateral rotation in vertex presentations alone would in all probability be nearer 90 than 70.

Chaignment has carefully investigated thirty cases, with the following results:

21 were O.L.A. with right rotation = 70 per cent.
1 was O.L.A. with no rotation = 3.4
3 were O.D.P. with right rotation = 10
3 were O.D.P. with left rotation = 10
2 were O.D.P. with no rotation = 6.6

That is to say, in 80 per cent. there was distinct right rotation, in 10 per cent. there was left rotation, and in 10 per cent. there was no appreciable rotation at all.

There were 22 primary O.L.A. cases = 73.4 per cent.
There were 8 primary O.D.P. cases = 26.6

The vertex lay in the right oblique diameter of the pelvis in every case to begin with; one changed to O.L.P. at the beginning of labour. Chaignment's cases will be more fully considered afterwards.

We are, I think, therefore justified in concluding from the foregoing statements that in vertex cases the uterus is rotated to the right on its longitudinal axis in at least 80 per cent. of cases, probably more. Breech and face cases also present most commonly in the right oblique diameter of the pelvis, and from this circumstance we may in like manner reasonably conclude that the transverse axis of the uterus in the majority of these presentations also occupies the right oblique diameter of the pelvis.

I have on two occasions been able to verify these statements at post-mortem examinations. In both cases the long axis of the vertex was lying in the right oblique diameter of the pelvis, and the foetal back lay forwards and to the left. Both uteri were distinctly rotated to the right, and their left borders came forward.

Charpentier says that rotation of the uterus to the right always occurs in pregnancy, and agrees with Spiegelberg in stating that the position of the foetal head, face, and breech depends upon the conformity of the uterus to the pelvis. Tarnier and Chantreuil also coincide in this opinion.

(To be continued.)

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