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Transposition of Viscera.

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NOTICE OF THE DISSECTION

OF A CASE OF

LATERAL TRANSPOSITION OF THE VISCERA OF THE THORAX AND
ABDOMEN IN A MAN.

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[*From the GLASGOW MEDICAL JOURNAL for July, 1853.*]

IN the course of last winter, a case of nearly complete lateral transposition of the viscera of the thorax and abdomen was met with in the dissecting-room of the University, and as instances of this remarkable malformation are by no means common, the readers of this journal may be interested with an account of it.

The subject of this case was a man of about 48 years of age, above the middle size, and of rather a robust frame of body. He was by trade a marble cutter, and a native of England; but nothing more of his history was known, than that he had been subject to rheumatism in early life, and about eight years ago had suffered from an attack of pleurisy.

He was admitted into the hospital of the City Poor's-House on the 28th of January, and died on the 4th of February last, or seven days after his admission. The above information, and the following particulars as to his state during the time he was in the hospital, were furnished by Mr. Marshall, house surgeon to the hospital.

On admission, this man's face and lips were livid; there was considerable difficulty of breathing, and he expectorated large quantities of thick yellow mucus. The origin of the disease was not learned. The lungs appeared to be the principal seat of disease. Percussion of the chest gave a clear sound towards the upper and front part of the lungs, but on the left side, below and behind, there was considerable dulness of sound. The sounds of the heart as heard by the stethoscope, appeared to be nearly natural as regards their rhythm and intensity; but the stroke of the heart was felt on the right side of the sternum, and the sounds were heard more loudly on that than on the left side. The first sound was rather weaker than natural, and was best

heard under the right nipple, where its beat was also felt most distinctly.

Although the altered position of the heart was detected, it was not before death ascertained to have arisen from malformation. The urgency of the symptoms, and the extent to which the disease had proceeded, probably precluded that minuter examination which might have been made at an earlier period. Some œdema of the extremities had begun, and the patient was supposed to have died from the combined effects of disease of the lungs and heart; while the displacement of the heart was attributed probably to empyema on the left side, where the dulness of sound, caused, as it appears, by the liver, was perceptible.

The dissection of the body had proceeded some way, and the thorax was opened, when I perceived the nature of the case, from the position of the heart towards the right side, and the arch of the aorta passing over the root of the left lung; and, on opening the abdomen, I found that the malformation extended to that cavity. A muco-purulent effusion into the pulmonary tissue and bronchial tubes, and some degree of enlargement of the heart, were the only morbid appearances, relating to structure which were observed; and in all other respects, with the exception of the transposition, there was no deviation from the natural condition of the viscera.

A lengthened detail of the dissection in this case is altogether unnecessary, and the accompanying drawing will indicate sufficiently clearly the general nature of the malformation. It might almost be described in the words of Isid. Geoff. St. Hilaire, as applied to the complete form of the transposition of the viscera, or, as he has termed it, *splanchnic inversion*—viz. that the non-symmetrical organs of the thorax and abdomen are placed precisely as they would be seen in an image of the natural ones reflected from a mirror. But in the case before us the inversion was not quite complete, the stomach, with some adjacent organs, having in part retained their position on the left side.

The heart pointed to the right side, and the arch of the aorta passed over the right side of the trachea and gullet, instead of the left. On opening the pericardium, the pulmonary ventricle and the systemic auricle were seen therefore to the left of the heart, with the vena cava superior on the left side descending into the latter cavity. The main pulmonary artery, rising from the pulmonary ventricle, wound round the right side of the aorta, to pass below its arch. Three principal arteries similar to the usual ones, arose from the arch of the aorta, the first one being the innominate, dividing into the left carotid and subclavian arteries, while the right carotid and right subclavian arteries arose separately, and in succession, from the arch of the aorta. The remains of the ductus arteriosus joined the hollow of the arch towards the

right, and was connected with the right instead of the left branch of the pulmonary artery.

The left vena innominata was short and vertical, and the right one long, and passing obliquely across the arteries rising from the arch of the aorta.

The principal vena azygos was situated on the left of the bodies of the dorsal vertebræ, and joined the superior vena cava by passing over the root of the left lung instead of the right.

The pneumogastric nerve gave off its recurrent branch round the subclavian artery on the left side, and round the arch of the aorta, close below the remains of the ductus arteriosus on the right side.

The relative position of the descending aorta to the vena azygos and thoracic duct in the thorax, and to the vena cava inferior in the abdomen, was similarly modified; and the latter vessel passed from the abdomen into the systemic auricle of the heart, through an opening of the diaphragm situated between the middle and left divisions of its trefoil tendon.

The right lung was divided by the oblique fissure into two lobes, and was hollowed out at its inner and anterior lower portion, as the left usually is, for the accommodation of the heart. The left encroached, when inflated, beyond the middle of the sternum at its lower anterior margin, and was divided into three lobes by the oblique and transverse fissures.

On first opening the abdomen, the intestines were found only partially covered by the omentum, which was thrown up and to the left side.

The liver was placed in the left hypochondriac and epigastric regions, the large (right) lobe towards the left, the smaller towards the right, the gall bladder, and everything else similarly inverted.

The caput cæcum coli was situated in the left iliac fossa, from which, after ascending a little way into the left lumbar region, it passed in front obliquely across the abdomen, deeply into the right hypochondriac region. A considerable part, therefore, of what might have formed the transverse part of the colon, was sunk in the right hypochondrium, which, as will be seen, was not otherwise occupied; the descending colon was on the right side; the sigmoid flexure was attached in the right iliac fossa and joined the rectum over the right brim of the pelvis.

The greater part of the small intestines, from near the upper part of the jejunum downwards, occupied the middle and right side of the abdomen, and the mesentery and great mesenteric artery and vein, presented the same transposition. But the stomach, spleen, pancreas, duodenum, and a small part of the jejunum, though not altogether naturally disposed, had not undergone a change of place similar, or to the same extent, with that of the other parts already described.

The stomach, of a somewhat elongated form, was placed chiefly

in the left hypochondriac region, below the larger part of the liver and gall bladder; but as the gullet passed through its usual place, near the middle of the back part of the diaphragm, the cardiac portion of the stomach was much drawn up, first below and next behind the smaller part of the liver, while the body of the organ lay lower down than the liver, in the left hypochondriac and lumbar regions, and the pyloric portion stretched from this forward, and downwards towards the middle of the abdomen. Here, or a little to the left of the middle line, it joined the duodenum, which was raised from its usual deep situation, but otherwise nearly in its natural place, being directed towards the right, then curving downwards, and lastly, joining a portion of intestine which crossed the middle line towards the left, and making a sudden turn back to the right, passed behind the mesenteric vessels to terminate in the part of intestine corresponding to the commencement of the jejunum on the right side. This portion, directed towards the left, could not be regarded as the duodenum transposed; for it was not attached to the pancreas, and was rather to be looked upon as a portion of the jejunum drawn out of its place. On the part of intestine which has just been described, as intervening between the duodenum and the transposed jejunum, and which might be considered as a part of the latter drawn out of its usual relations, a small diverticulum existed, about an inch and a half in length and width, and of a rounded sacculated shape. It is worthy of remark, that this diverticulum was precisely in the situation in which we might expect it to be found, supposing it to arise in connexion with the remains of the ductus vitello-intestinalis of earlier foetal life, and was held forward to the abdominal parietes by peritoneal adhesions.

The spleen was attached as usual to the great curvature of the stomach, and placed along with it lower than it usually is under the liver in the left hypochondrium. The pancreas was placed as usual with its larger end in the hollow of the duodenal curve, and extended thence towards the spleen, its position departing only slightly from that of the natural organ, in consequence of the deviation of the duodenum.

The kidneys were naturally placed, excepting that the left was somewhat the lower of the two.

I regret that the existence of complicated adhesions between the abdominal and visceral peritoneum in the vicinity of the duodenum, which matted together several of these parts, prevented me from ascertaining with precision the state of the foramen of Winslow, and of the lesser cavity of the peritoneum, together with the attachments of the great omentum, as I thought that considerable interest might have attached to the examination of these parts, had they not been so obscured, more especially in connexion with the modification in this case of that process of folding by which the colon, originally straight and nearly sym-

metrical, is laid up and across the abdomen, so as to form the transverse portion, and carry the cœcum into the right iliac fossa.

This, then, is an example of that kind of malformation in which, apart from the accidental disease which caused death, all the organs are of healthy fabric, of the usual size, fully developed, of natural structure and consistence, with nothing deficient nor redundant, but have merely undergone such a change of place in some, and of form in relation to position in others, that those parts of organs or entire organs, which are usually on one side of the body, have been transposed to the opposite side.

This is apparently not a very uncommon affection, and it is subject to some varieties of degree. In some, and apparently the greater number of cases, the transposition affects all the viscera; in others, only one or more of them. The heart especially, and the liver, appear to be those most constantly transposed.

This state of the viscera does not appear to exert any hurtful influence on the functions. Its existence has been detected in persons at various ages during life, and with the exception of the beat of the heart being felt on the right side, (by which indeed the condition has generally been recognized,) no unpleasant or unnatural symptom of any kind has been observed.

Isidore Geoff. St. Hilaire mentions his having seen living instances; and I remember my father, Dr. John Thomson, detecting this state of the heart in a medical student attending his lectures, and who suffered no inconvenience whatever from it. It was not indeed to be expected that there should be any, seeing that all the accompanying or connected viscera are similarly affected, and that the harmony and simultaneous actions of all of them are preserved.

It might be desirable to know whether any change was perceptible in these individuals in the more regular or symmetrical organs; for example, whether they are left handed. But I am not aware that observations on this point have been made.

The majority of the cases that have been described have been in adult men, but it has been observed also in women, and in children, and in one of the latter it was detected during life.*

The earliest observation of transposition of the viscera recorded is that by Riolan, in 1652, in the history of the dissection of a robber who had been broken on the wheel, but in whom nothing of the malformation had been detected during life. The first case which was ascertained during life, was that of a pensioned soldier of seventy-two years of age, observed and described by Morand, and reported on by Méry, in the *Memoirs of the Academy of Paris*, for 1666. The case seems to have attracted a great deal of notice at the time, and is supposed to have suggested to Molière the transposition of the heart and liver, which he puts into the mouth of

* Isid. Geoff. St. Hilaire, *Hist. des Anomalies*, &c. Paris, 1832; vol. 2.

Sganarelle in his play of *Médecin Malgré lui*, which was first published about the same time.

This condition appears to belong to that class of malformations which admit of some explanation from the observation of development, as it seems to proceed from a derangement or deviation from the natural progress of that process at a very early period. It is a general fact, that the commencement of all the most important malformations dates from a very early period of development. The degree to which the various kinds of malformations may be so elucidated is very different. In regard to some, great advance has already been made by a careful comparison of their abnormal structure, with the rudimentary and imperfect conditions of the parts in the earlier stages of their growth, and we may hope that, as our acquaintance with the phenomena of embryological development proceeds, and more accurate dissections of the malformations themselves shall be made, still greater light will be thrown upon their origin.

The origin of malformations by defect has more particularly been very fully explained by embryological investigations, which have shown that the greater number of these malformations may be looked upon as arrests, checks, or modifications of some parts of the changes of the natural process of development. A second class of malformations, exhibiting considerable variety of forms, are to be attributed to morbid processes, diseased growths, unnatural adhesions, constrictions by foreign substances, &c. occurring also in the earliest stages of foetal life, and giving rise to very various defects, both of the internal and external parts of the body, and may depend either on the original defect of the germ, or on foreign and accidental causes acting in the course of foetal development. A third class of malformations, those, viz. of redundancy of parts, and the various degrees of double monstrosity, admit of explanation only on the supposition of an original abnormal condition or tendency of the germ, and have received only collateral elucidation from embryological observations, in so far as these have pointed out the general phenomena of the formative process by which the combined organs, or the pairs of organs, of a double foetus are developed in unison, or in various degrees of fusion; and it has been ascertained that these phenomena do not deviate essentially from those of the natural process, excepting in the circumstance of duplicity. A fourth class of malformations, to which the one at present under consideration belongs, viz. those of unnatural position (*situs mutatus*), admit of being divided into two sections; in one of which, single organs, or pairs of symmetrical organs, are entirely displaced from their natural situation. In some of these, the unnatural position is more or less that in which the organ is originally formed in the foetus, as in the case of the genital organs, and these malformations, therefore, are, like many of those in the first mentioned class, to

be attributed to defect or arrest of development. In others, of the nature of hernia, the causes of displacement may be very various and less regular. But the very peculiar malformation of which the case now described is an example, is of a different kind, affecting non-symmetrical organs, and probably arising from, or connected with, some derangement in the position of the whole embryo at the period when the relations of organs are more immediately fixed by the course of their formation.

It would appear, therefore, that this kind of malformation, which is scarcely described with sufficient precision for some of the parts by the words change of position, lateral inversion, or transposition, as it consists in the exchange of sides by the parts of some, as well as of the whole of others of the laterally non-symmetrical viscera of the chest and abdomen, admits also of a certain amount of elucidation from the consideration of embryological development, as was first suggested by the most acute and enlightened of embryologists, Prof. Von Baer of Königsberg.

It is generally well known that in the earliest stage of development of all vertebrate animals, the rudiments of the embryo, which then consist chiefly of the cranio-vertebral axis, are placed on the upper surface of the membranes of the yolk, in connexion with which they are formed, in such a manner that the part which is afterwards to be the front of the body is placed symmetrically prone, or looking downwards on the yolk. The first change which occurs from this prone position, at the time when the head and upper part of the body are isolated or notched off from the formative layers of the yolk, consists in a twist or rotation between these upper parts (that is, the head and thorax,) and the abdominal and caudal portions, which still lie prone on the surface of the yolk. This twist goes on along with other changes, unnecessary to be specified here, till it has reached the extent of a quarter of a circle, and at a somewhat later period, when the abdomen and umbilical passages are closed in, is followed by a turn of these parts also on the yolk; so that the embryo comes to lie with its left side applied to the surface of the yolk, and the first umbilical passage, (ductus vitello-intestinalis and vessels, not yet forming a true umbilical cord,) passes from the left side of the body of the embryo to the surface of the yolk.

"This movement of rotation to the left, which the embryo performs," says V. Baer in the first part of his *History of Development*, in describing the changes occurring on the third day of incubation in the common fowl's egg, "is a very important moment in the history of the development of the fœtus; for with this movement are intimately connected many changes, and more particularly the metamorphosis of the heart. The left side of the embryo already presents, from this time of development of the sanguiferous apparatus, a physiological difference from the right side, for it is in relation to the latter the side of reception." The

ascending and descending veins are at first placed on the left side exclusively, or if there are two, the left is the largest. The open part of the alimentary canal, by which it communicates with the cavity of the yolk, is placed more to the left; and when the rotation is complete, the left side of the embryo is towards the surface of the yolk.

V. Baer points out that in all animals in which the germinal membrane does not surround the yolk from the first, but extends gradually over it, the same sort of isolation of the foetus from the yolk takes place, and the same relative situation is observed in the earlier periods between the embryo and the yolk; at all events, in the sauria, ophidia, birds, and mammalia, the embryo is always, in the second stage of its development, placed with its left side towards the yolk. In several hundreds of embryo-chicks, V. Baer has only observed two in a different position, or with the right side towards the vitellus. In one of these the turn was incomplete, and the heart was natural; but in the other, in which the rotation was complete, the position of the heart was inverted, so that the part usually towards the left was turned towards the right, &c. "I cannot doubt, therefore," says Von Baer, "that in this case there was a commencement of transposition (*situs inversus*)."

"I have," continues this author, "more frequently found the umbilical vesicle situated to the right of the embryo in mammalia, particularly in the pig, which may depend upon the less firm support which the membranes of the ovum receive from the external coverings in viviparous than in oviparous animals."

A considerable number of years ago, when investigating the phenomena of development of the bird on an extensive scale, I observed only once out of many hundred incubated eggs of the common fowl, the embryo on the third day lying on its right side. I did not in that case attend to the state of the heart. But in a goose's egg of a corresponding period of advancement, I also once saw the same deviation from the natural position most distinctly, and in this case the position and form of the heart and vessels connected with it, were quite inverted; but the other viscera were not sufficiently advanced to enable me to observe whether the inversion had extended to them.

I have elsewhere * called attention to the fact, that in the case of double monstrosity, while the one of the united individuals that is situated to the right of a person looking at them in front is naturally formed, in the other the heart and non-symmetrical viscera are laterally transposed, as in the case of the man under consideration. The viscera in the two individuals of a double monster together therefore form a symmetrical whole; and I have adduced this fact, in confirmation of the suggestion of Von Baer as to the

* Paper on Double Monsters in the London and Edinburgh Monthly Journal. 1844. See also Serres' Recherches d'Anat. Transcend. and Isid. Geoff. St. Hilaire Hist. des Anomalies. 1832.

connexion between the malformation of transposition, and the original position of the embryos on the surface of the yolk; because I have shown that in the original formation of double monsters, the two germs lie adjacent to one another, in the germinal area of the single yolk: both are at first prone, but if the germs are sufficiently apart to lead to the formation of two cranio-vertebral axes, with two visceral cavities, while the one individual (viz. that to the left of the person viewing them from above as they lie on the surface of the yolk) rotates so as to have the left side applied to the yolk, the other embryo makes an opposite turn, so as to have the right side downwards or next the yolk. Looking at these embryos from below, or in front, or from the yolk side, the one to our right is that which is natural, that to our left is the one affected with transposition of the viscera. Taking the middle line therefore of the two, the apex of the heart is directed outwards from this line in both, the arch of the aorta, the stomach and spleen, are to the outside, and the liver, duodenum, and caput cœcum coli to the inside. But it must not be forgotten that, in the earlier stages, and through a considerable part of foetal life, the difference between the one side and the other (as for example in the liver) is not so great as it becomes after birth.

Bischoff in his admirable article on the Application of the History of Development to Malformations, &c. in *R. Wagner's Handwörterbuch der Physiologie*, has called attention to the fact, that while the umbilical vesicle or yolk is placed, as I have stated above, to the left of the embryo, the allantois passes usually to its right side. But the development of the latter membrane takes place principally at a later period than that at which the position of organs in the course of formation is determined; for the umbilical cord is by that time contracting into a longer and narrower communication between the embryo and membranes of the ovum.

At that earlier period, corresponding to the second day of incubation in the common fowl, and the third week probably in the development of the human embryo, when the formative processes are most active, and the structure and relations of the most important viscera are determined by the condition in which their foundations are laid, the position in which the embryo lies, in relation to the yolk, may unquestionably, as Von Baer has suggested, determine the position and relations of the heart and great vessels connected with it, and very probably also that of the alimentary canal, liver, and accompanying viscera. But perhaps it may be premature, in the present state of our knowledge, to place together the malposition of the embryo as regards the yolk, and the lateral inversion of the viscera, in the relation of necessary cause and effect, for it is quite possible that some other unknown antecedent affection of the germ may determine them both.

Future investigations into the history of development, which have already done so much to elucidate the origin of certain

kinds of malformation, may hereafter make us more fully acquainted with the circumstances which determine, or the general laws which regulate, the lateral deviations from natural position. Meanwhile, the examination of the position and structure of the embryo in its earliest phases of growth, as related to these and other malformations, cannot be too earnestly recommended to all those who make embryology a special subject of attention.

There are no facts on record to enable us to decide, whether the transposition of the viscera is, like many other malformations, hereditary. But even without this being determined, it is right to state that in attributing the origin of certain malformations to some original peculiar constitution of the germ, and of others to changes or injuries which are ascertained to occur in the progress of development, to the latter of which divisions the malformation of transposition appears most probably to belong, it is by no means intended to be denied, that there may in these cases also be a *nisus* or predisposition belonging to the germ originally, and derived by it possibly like other qualities from hereditary transmission.

In offering such explanations of the origin of malformations, I do not profess entirely to discover their cause, but rather attempt to point out that part of the process of development with which they are most intimately and constantly connected. In the case before us it has been shown, that the partial or entire transposition of the non-symmetrical viscera, is most immediately related to the change of position which occurs at the earliest period of formation of the heart and its main blood vessels, the liver in connexion with one of those blood vessels, and the alimentary canal.*

NOTE.—The drawing represents the transposition of the heart and great blood vessels—the liver on the left side, and the pyloric end of the stomach appearing beneath it. The caput cœcum coli, with the vermiform appendix, is seen in the left iliac fossa. 1. Right auricle of the heart; 2. Superior vena cava; 3. Inferior vena cava; 4. Vena azygos; 5. Right ventricle of the heart; 6. Pulmonary artery; 7. Left ventricle of the heart; 8. Aorta, (*a*) arteria innom. left side, (*b*) arteria carot. right side, (*c*) arteria subclav. right side, (*d*) ductus arteriosus; 9. Ensiform cartilage and cartilages of ribs; 10. Liver, (*e*) gall bladder; 11. Stomach; 12. Caput cœcum coli and ascending colon, (*f*) appendix vermiformis; 13. Small intestines; 14. Dotted line showing the position of the pylorus and duodenum, behind the colon; 15. The lungs indicated by dotted lines—two-lobed on the right, three-lobed on the left.



D^r ALLEN THOMSON'S
CASE OF TRANSPOSITION OF THE VISCERA.

