Remarks on diaphragmatic herniae / by Arthur Keith.

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Remarks
ON
DIAPHRAGMATIC HERNIAE.

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IF one may judge from current medical literature, the passage of viscera from the abdomen to the thorax through a defect in the diaphragm is not an uncommon form of hernia. Dr. J. W. Ballantyne found records of 100 cases published between 1888 and 1900; an excellent article on 63 cases was published by Mr. Lawford Knaggs in 1903; in the same year M. Paillard was able to give references to 481 described cases. In spite of the extensive literature, the cause and significance of the defects of the diaphragm which render such hernia possible are ill understood—a natural result of our present imperfect knowledge of the origin and history of that muscle. The history of the diaphragm is linked up with that larger and still unsettled problem—the origin of the mammals, and especially of their peculiar respiratory mechanism. At the present time the diaphragm is regarded by most anatomists as a septum which has grown across the coelomic cavity, dividing it into pleural and peritoneal compartments. When, however, one begins to account for the various characters of the diaphragm, its origin in the neck of the embryo, its nerve supply from the fourth and fifth cervical nerves, and especially for the manner in which this effective part of the mammalian mechanism gradually assumed its present functional character, it becomes evident that its origin as a transcoelomic partition provides a very imperfect working hypothesis. The explanation I offered in the *Journal of Anatomy and Physiology* some five years ago still appears to me the most satisfactory. The pleural cavities are, to my way of thinking, similar in many respects to the tunicae vaginales; both are extrusions or extensions of the primary coelomic cavities, but whereas the testicles have extruded in front of them an extension of all three primary layers from the hind-end of the primary abdominal cavity, the lungs perforate only the inner of the three layers of the fore end of that cavity, and instead of being extruded in the

neck push down this inner layer to form the diaphragm. The lungs as they develop thus become lodged as it were in the body wall, as one might conceive happening in the case of an imperfectly descended testicle at the groin. The inner or transversalis layer at the cervical end of the primitive abdomen was originally composed, as one may see in some modern amphibia, of a dorsal and ventral sheet of musculature, both of which were attached to and acted on the pericardium and roots of the lungs. Hence, with the downward dislocation of the cervical inner sheet to form the diaphragm, the pericardium and heart are also carried within the body cavity. Clinicians are well aware that all nerve manifestations connected with the diaphragm, and with the diaphragmatic aspect of the liver, are still referred to the areas supplied by the original (fourth and fifth) nerve segments.

I.—*Hernia through the Pleuro-peritoneal Passage.*

My purpose here is to refer to this migration theory of the lungs merely as far as it helps us to understand the various forms of diaphragmatic herniae. In Fig. 1 I have summed up in a diagrammatic manner the results of an examination of thirty-four specimens which show defects of the diaphragm. These specimens are preserved in the medical museums of London. It will be observed that seventeen of these specimens show a defect at the dorsal or spinal part of the left side; four at a corresponding position on the right side. These two defects or openings I have named the pleuro-peritoneal passages, and I regard them as similar to the internal abdominal rings—namely, the points at which the right and left lungs made their escape from the primitive abdominal cavity. The muscle of the crura of the diaphragm which separates these orifices represents the dorsal part of the cervical transversalis, while the sterno-costal fibres of the diaphragm represent a ventral part of the same sheet. In the normal course of development these orifices are closed before the end of the second month; but one can understand, as is the case with the internal opening of the tunica vaginalis, that the process of closure may be delayed or fail. The cause of the failure we do not know, but one may safely presume that it is of the same nature as the cause which arrests the union of the primary elements of the upper lip and leads to the condition of harelip. It is not the respiratory movements at birth which draw the abdominal contents into the thorax; the atelectatic and compressed condition of the left lung (when hernia is situated on the left side) shows that the abdominal contents had entered the left thorax long before birth, probably owing to the spasmodic movements which are known to occur in the fetus *in utero*. The size of the aperture in those children which died at birth is larger on the left side than on the right; on the left side the deficiency varies from one to two thirds of the floor of the left pleural cavity; on the right side the size is rarely so much as a third of the right pleural floor. The explanation of

the larger orifice on the left, and of its greater frequency (17 on the left to 4 on the right in the present series) is the same as leads to the greater frequency in the displacement of the right kidney in the adult. The contents of the left hypochondrium are much more movable and plastic than those of the right; hence, when the contents of the abdomen are compressed in the fetus with an open pleuro peritoneal passage, the massive liver blocks the orifice on the right, while the left contents may easily slip through. The case is otherwise when dislocation of the kidneys in the adult is considered. The mobility of the contents of the left hypochondrium safeguards the left kidney; the relative immobility of the liver renders the right kidney subject to all compressing influences which act on the right hypochondrium.

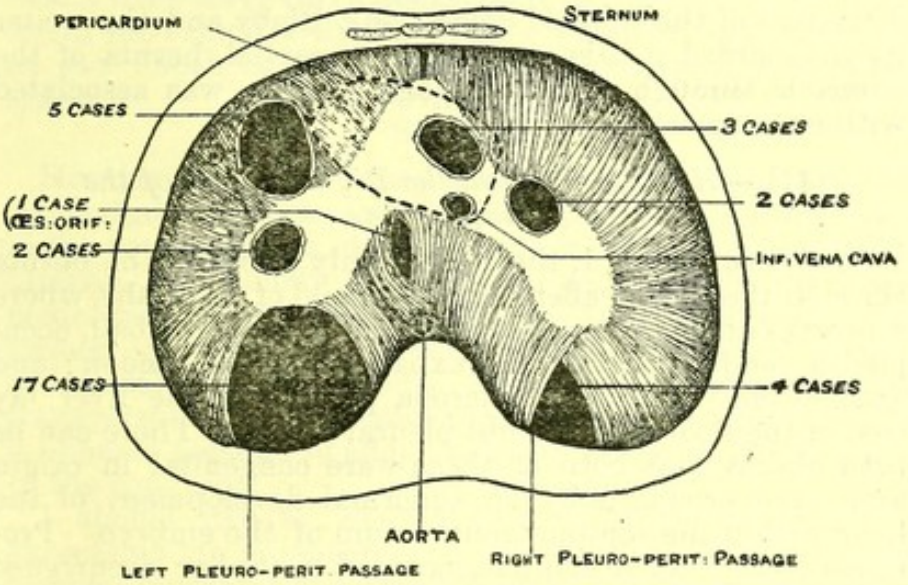

Fig. 1.—Diagram to show the sites of diaphragmatic hernia, as deduced from 34 museum specimens in London. The upper or thoracic aspect of the diaphragm is represented.

Of the 4 cases of hernia through the right pleuro peritoneal passage, 2 died at birth, 1 lived one and a half hours, another 4 hours. Of the 17 cases on the left side, 12 died at birth or were stillborn, 1 lived six hours, 1 six weeks, 1 three months, 1 to the age of 34, and 1 to old age. Dr. Penrose Williams has recorded a case in a man of 77, and a case of Dr. Edmund Cautley, recorded by Mr. H. D. Williams, lived to 9 months. Dr. R. J. Gladstone has described the case of an anencephalic fetus where the fused kidneys had entered the left side of the thorax by the pleuro-peritoneal passage; and also the case of a woman of 96 where the right passage was distended by a fatty hernia. Professor A. M. Paterson of Liverpool and Professor Arthur Robinson have dealt with the anatomy of this form of diaphragmatic hernia. Mr. Lawford Knaggs, when he reported a series of 63 cases seven years ago, said he was aware of only two cases in which an operation had been attempted—a case of his own and one recorded by Mr. James Berry. Neither of

these cases was congenital hernia of the pleuro peritoneal passage. From an examination of the present series of cases I am of opinion that a considerable number of these cases might be successfully operated on if the condition were recognized at the time of birth.

II.—*Hernia through the Oesophageal Orifice of the Diaphragm.*

As may be seen from Fig. 1, there was only one specimen in the series of 34 which showed a hernia at the oesophageal orifice. This specimen is in the museum of Guy's Hospital, and shows the greater part of the stomach in the right pleural cavity. Mr. Lawford Knaggs has described several cases; Mr. W. A. E Waller has recently placed a remarkable one on record in a young man of 19; Dr. Barclay Smith found the condition associated with great dilatation of the sigmoid colon. Mr. Rigby and the writer have recorded a case in which a partial hernia of the stomach through the oesophageal orifice was associated with enteroptosis.

III.—*Herniae through the Right Leaflet of the Diaphragm.*

As shown in Fig. 1, there were only two cases of hernia through the right leaflet—one in a child of 4 months, where a process of the liver, about the size of a cricket ball, occupied a sac formed from the expanded central tendon; and another, also in a child, where a process of the liver lay free in the floor of the right pleural cavity. There can be little doubt that both of these were congenital in origin and were produced by an abnormal development of the liver within the septum transversum of the embryo. Professor Arthur Thomson has recorded a similar occurrence in the rabbit, the abnormal process of liver resembling an accessory heart.

IV.—*Hernia into the Pericardium.*

There were three cases of hernia into the pericardium through a perforation of the central tendon of the diaphragm. In the case of a man of 50 a process of omentum occupied the orifice; in a man of 47 a process of liver formed the extruded part. In neither of these cases was there a hernial sac, but in the third case, in a child at birth, the process of liver was enclosed in a sac formed by the central tendon. It is possible that the two cases in adults were the result of a former injury. Elder and Postlethwaite report a case where the lobe of a malformed liver occupied a diverticulum of the right central tendon, the diverticulum reaching the level of the second rib.

V.—*Hernia through the Left Dome of the Diaphragm.*

Herniae through the left pleuro-peritoneal passage are four times more common than through the right, and the same statement holds true as regards the various forms of hernia which occur at the domes and sterno costal

parts of the diaphragm. As may be seen from Fig. 1, herniae occur at two sites on the left dome—an anterior or sterno-costal site, and a posterior or central site. In the present series of 34 cases there were 5 at the sterno-costal site and 2 at the central. Of the sterno costal form all were in adults varying in age from 19 years to 50, and in every case there was a history of a former injury by which the abdomen had been suddenly and forcibly compressed. There was no specimen of hernia at this site in a newly-born child. Cases of hernia in adults as the result of a former injury have been recorded by Mr. Lawford Knaggs, Professor A. M. Paterson, Mr. J. P. Roughton, and Mr. Don. In the two central cases the abdominal contents were enclosed by a sac formed from the extended diaphragm in one case (a child which lived forty-three hours), and in the other (a child at birth) the orifice in the diaphragm was free, and there was no sac. Both of these cases were clearly of congenital origin.

Summary.

Herniae through the diaphragm fall into two groups, the congenital and the acquired, the former being to the latter in the present series of 34 cases as 26 : 8. The congenital herniae are chiefly those which occur at the unclosed pleuro-peritoneal passages (21 cases), the others being formed (5 cases) by developmental extrusions of the abdominal viscera, chiefly liver, through the septum transversum. In a certain proportion of congenital cases it appears possible to adopt surgical measures for the cure of the condition.

I should like to avail myself of this opportunity of expressing my indebtedness to the curators of the various hospital museums in London for the facilities given me of examining the valuable specimens under their care.

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