Ten cases of congenital contraction of the stomach : with remarks / by W. Roger Williams.

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CONGENITAL CONTRACTION OF THE STOMACH,

WITH REMARKS.

BY

W. ROGER WILLIAMS, F.R.C.S.

SURGICAL REGISTRAR TO THE MIDDLESEX HOSPITAL.

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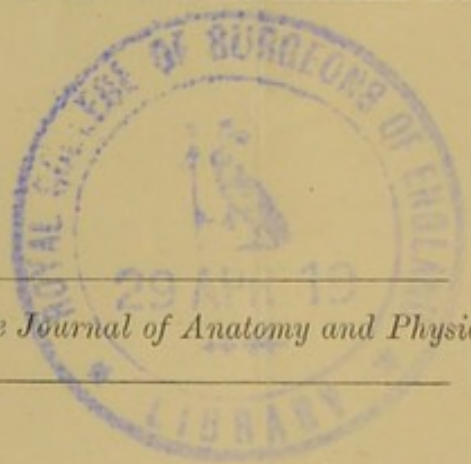

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Fig. 1.

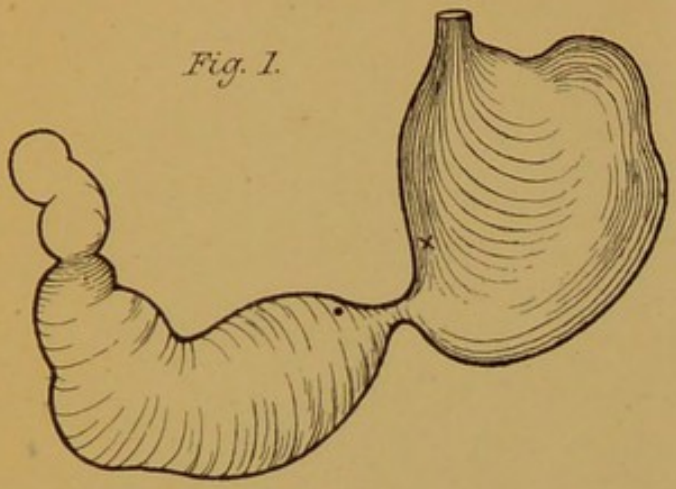


Fig. 2.

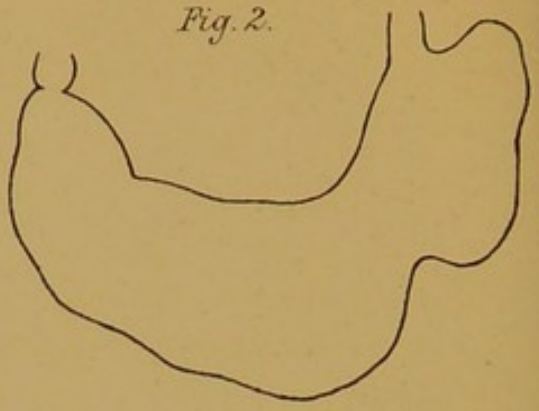


Fig. 3.

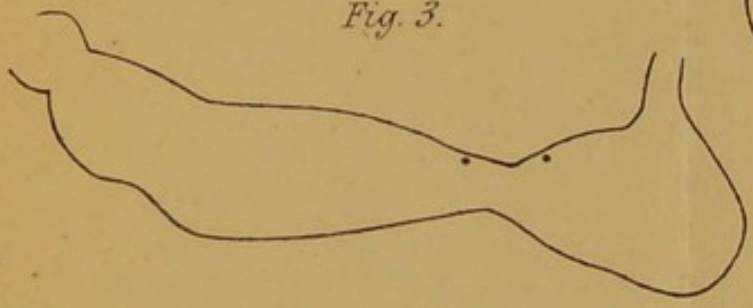


Fig. 7.

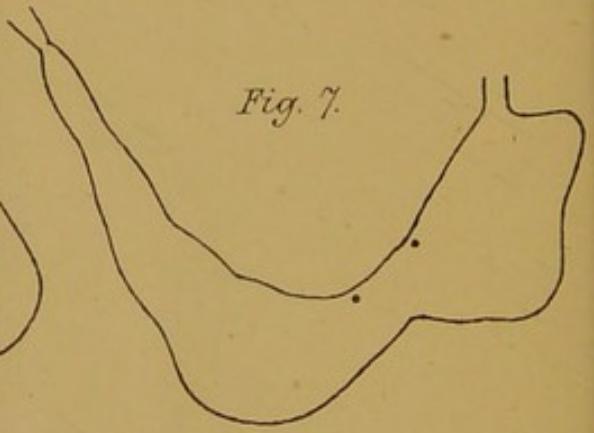
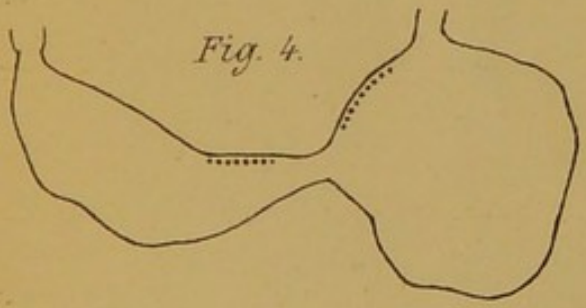


Fig. 4.



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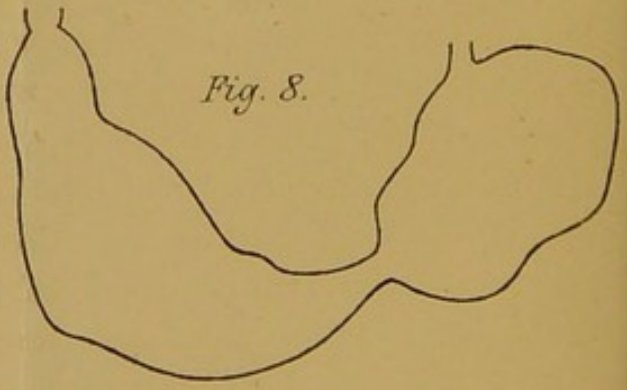

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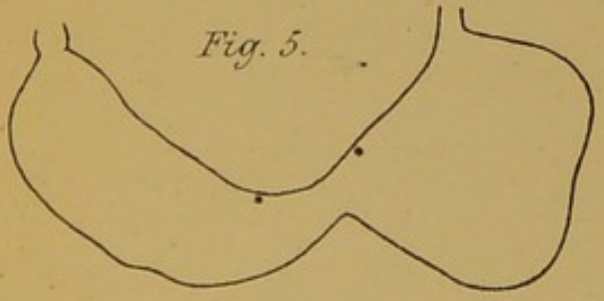


Fig. 9.

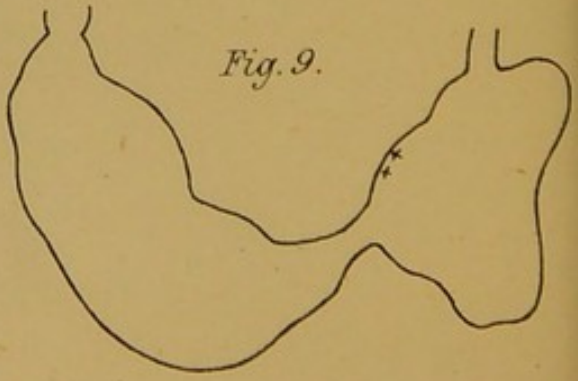
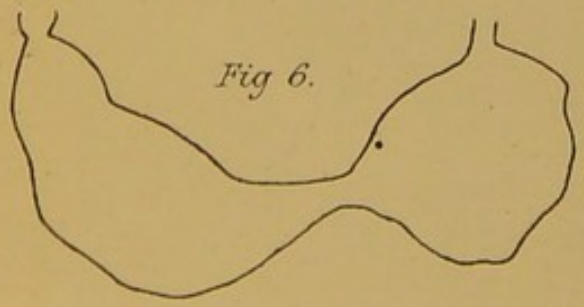


Fig 6.



P. Heath, Lith. Edin.

TEN CASES OF CONGENITAL CONTRACTION OF THE STOMACH, WITH REMARKS.

By W. ROGER WILLIAMS, F.R.C.S., *Surgical Registrar to the Middlesex Hospital.*

Case I.—In the course of dissection at the Middlesex Hospital, in the Winter Session of 1879, I noticed a singular deformity of the stomach.

The body was that of a woman, aged 72, who had died in the workhouse, a month previously, of cerebral disease and apoplexy. When alive she was remarkable for her voracious appetite. No further particulars could be obtained.

Viewed *in sitû* the stomach consisted of two divisions (*vide* fig. 1, for which I am indebted to Mr Hensman), separated by a narrow contraction, nearer the cardiac than the pyloric orifice. Of these the cardiac one appeared much the larger; it was of pyriform shape, with the base above and the apex below, at the seat of contraction. The pyloric division was elongated, tapering at each end, and bulged in the middle. At the narrowing these divisions of the organ were approximated by a flexure of the small curvature, the cardiac pouch being received into the concave upper border of the pyloric one.

The organ also presented two other slight contractions, viz., one, in the cardiac division, on the side of the great curvature, marking the limit of the great cul-de-sac; and the other, in the pyloric division, on the side of the small curvature, marking the limit of the small cul-de-sac.

The former of these divisions had a shiny, membranous appearance, and in the vicinity of the cardia the longitudinal fibres from the œsophagus could be seen radiating over it, a very strong band passing to the small curvature; the latter was dark

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EXPLANATION OF PLATE.

Fig. 1. (×) Seat of ulcer; (') seat of erosion. Fig. 3, 5, 6, 7. The dots are seats of scars. Fig. 4. The rows of dots are seats of hard plates. Fig. 9 (× ×), small erosions.

and fleshy looking, the transverse arrangement of its surface fibres being very obvious. Contrary to what is usual, the walls of the cardiac part of the organ were thicker than those of the pyloric.

With the viscus moderately distended, the length of the strictured part was 1½ inch, the maximum contraction being in the middle, which was distant 4½ inches from the cardiac orifice and 5½ from the pyloric, measured along the small curvature. Between the same points, along the great curvature, the distances were 9½ and 13 inches respectively. The contraction appeared to have been formed chiefly by an infolding of the great curvature. In its natural position, there was no obvious puckering or irregularity; but a smooth, shiny, even surface. To its upper border, however, the tail of the pancreas, unduly hard and enlarged to the size of a walnut, was adherent. The external circumference of its narrowest part was 2 inches, that of the pylorus 3 inches. Similar measurements round the largest parts of the cardiac and pyloric sacs gave 9 inches and 7½ inches respectively. About an inch to the cardiac side of the maximum contraction, in the small curvature, a slight irregularity and well-marked thickening could be detected on manipulation, over an area rather larger than a shilling; in the corresponding position, on its pyloric side, a similar indurated area, only smaller, was also made out. Otherwise the contracted part, like the rest of the organ, presented no obvious lesion. As the body had been injected I dissected the various gastric arteries. It was then obvious that the vascular arches along the curvatures were interrupted, each division of the organ having a separate blood supply, whose main trunks arose in the vicinity of the cardiac and pyloric extremities; and as their terminal branches approached the seat of contraction, they rapidly dwindled away. The only communication between the two sets of vessels was by a few exceedingly minute twigs in the latter situation. After its removal from the body the stomach was fully inflated, but without producing the least alteration in the contraction. When in a state of moderate distension the cardiac pouch held 2 pints of water, the pyloric only 1 pint. It weighed 8 ounces; but this certainly conveys an exaggerated idea of its proper weight, for when put on the scales it was sodden with water.

On laying the organ open, its mucous membrane presented

throughout a perfectly normal appearance, with the exception that the rugæ of the cardiac pouch were unduly prominent. Both orifices were normal. The contraction was just large enough to admit a man's thumb. A callous-looking, oval ulcer, about half an inch long, was discovered on the small curvature, at a distance of nearly an inch from the seat of maximum contraction, and to its cardiac side. The tail of the pancreas had been adherent opposite this spot. At a corresponding position, on the pyloric side of the contraction, was a firm white cicatrix, as large as a pea, the site of a healed ulcer. There was no puckering or irregularity of the mucous membrane in either of these situations. Between them was a stretch of perfectly healthy tissue about 2 inches long, which included the whole length of the contracted area. Contraction had not taken place in the plane of either lesion, but in the intervening portion. These appearances seem to me to afford strong evidence that the lesions described were secondary to, and caused by, the contraction. In what other way can we account for their occurrence, in the positions most exposed to irritation, during the passage of food under such circumstances; and *not* in the plane of any contraction, as would have been the case had either of them *caused* such a condition?

There was nothing noteworthy about the condition of the other organs.

Case II.—For this specimen I am indebted to Professor Thane he removed it from the body of an elderly male, in the University College dissecting room.

The stomach in question (fig. 2) was a rather small, thick, and muscular one, weighing $5\frac{3}{4}$ oz.

It presented a well-marked contraction, formed chiefly at the expense of the great curvature, nearer the cardiac than the pyloric orifice. There was a slight infolding of the small curvature at the seat of constriction.

The cardiac pouch was ill-developed, and much smaller than the pyloric, than which its walls were thicker.

The usual slight contraction existed, limiting the small cul-de-sac.

No puckering or irregularity could be detected; in short, in other respects the organ appeared normal.

When moderately distended, the circumference of the largest part of the cardiac pouch measured 8 inches; that of the pyloric 10; the circumference at the seat of contraction was 6 inches.

Measured along the small curvature, the contraction was 2½ inches distant from the cardiac orifice, 3½ from the pyloric. When very fully inflated the contraction was not in the least effaced.

The mucous membrane in the cardiac pouch presented well marked rugæ; there were none in the pyloric pouch, except near the pyloric orifice. The latter had the appearance, not of a smooth, circular, patent ring, but of a narrow elongated passage, lined by longitudinally arranged rugæ, somewhat whorled, continued from the stomach into the duodenum for a short distance.

No induration, scar, ulcer, or other lesion could be detected in any part of the organ.

Case III.—Mr Shattock kindly called my attention to this specimen, No. 5513 in the University College Museum, being the stomach of a woman who died of cirrhosis of the liver.

The organ (fig. 3), which was small and elongated, consisted of a cardiac and a pyloric division, separated by a well-marked contraction, distant 2½ inches from the cardiac, and 6½ from the pyloric orifice, measured along the small curvature. The cardiac division was saccular in shape; the pyloric intestiniform —the latter being the larger and thicker. In other respects, as viewed from the outside, the stomach appeared normal. There was no sign of any adhesion between it and adjacent structures.

Internally, the mucous membrane of both divisions presented very prominent longitudinal rugæ. The cardiac and pyloric orifices were normal.

Situated in the small curvature, about an inch apart, were two small scars, one on either side of the constriction, from which each was equally distant.

Each scar was the size of a threepenny piece—smooth and whitish. The intervening tissues were perfectly normal; no puckering or irregularity could be detected. The organ presented no other lesions. The contraction was large enough just to admit the thumb and index finger.

Case IV.—No. 1795 in Guy's Hospital Museum. In the catalogue is the following brief description:—"Stomach showing hour-glass contraction about its centre." This specimen and the

succeeding one are very old; they were, I believe, presented to the museum by Sir Astley Cooper: there is no history with either of them. Dr Wilks alludes to them in his work on pathological anatomy. Neither specimen had been previously laid open and thoroughly examined. By the kind permission of Dr Fagge, I was able to do this some time ago, and in the presence of Dr Carrington, who was aware of my intention to publish them. He has since exhibited them at the Pathological Society of London, and included them in his paper in the *Transactions*,[1] forgetting, I am surprised to find, to mention this circumstance—accidentally, no doubt.

The organ I am about to describe (fig. 4) was a little under the usual size; externally it presented no obvious morbid appearance, other than the contraction, which was smooth, even-looking, and about an inch long. Of the two pouches, the cardiac was the larger. The walls of both were thin, and uniform in this respect throughout.

The centre of the contraction was distant $2\frac{1}{2}$ inches from the cardiac orifice, and 4 inches from the pyloric, measured along the small curvature.

In the latter part, two thin, flat, hard, oval plates, feeling almost calcareous, were detected,—one on either side of the contraction, separated by an intervening portion of perfectly healthy tissue, rather more than an inch in length.

The interior of the stomach had a normal appearance. No trace of any lesion could be seen. The plates in the small curvature were covered by healthy mucous membrane, beneath which they were situated. They were the result probably of chronic inflammation, excited by the undue impact to the food in these situations, owing to the existing deformity. The fact that they occurred in the precise localities so frequently occupied by ulcers in such cases, is an additional reason for believing that the latter usually originate, under similar circumstances, in this manner.

The contraction was very small, barely admitting the tip of the little finger. The cardiac and pyloric orifices were normal.

Case V.—No. 1796 in Guy's Hospital Museum. In the catalogue it is described as—"Stomach showing hour-glass con-

[1] Vol. xxxiii., 1882, p. 130 *et seq.*

traction about its centre; peritoneal surface at that part thickened and white."

The organ (fig. 5) was rather above the normal size; and the cardiac division was larger than the pyloric. Its walls were thick, but there was no appreciable difference between the two divisions in this respect.

The contraction was of the annular variety, and externally it presented a smooth and regular appearance.

An inch to its left, close to the small curvature, was a small stump of fibrous tissue, as if an adhesion had once existed there between it and some adjacent structure. At this spot there was an indurated area about the size of a sixpence. In the corresponding position, on the pyloric side of the contraction, a similar indurated patch could be felt. In this case, as in the previous ones, no lesion could be detected at the seat of maximum contraction. The distance from the latter to the cardiac orifice was 4 inches, to the pyloric $4\frac{1}{2}$, measured in each case along the small curvature. On examining the interior of the organ, a smooth, whitish patch was discovered, opposite each indurated area—to which the mucous membrane, elsewhere freely movable over the subjacent structures, was adherent; and around these spots were some radiating rugæ, suggesting the appearance of old scars. No trace of any other lesion. The stricture in this case only just admitted the end of an ordinary lead pencil. The cardiac and pyloric orifices were normal.

Case VI.—Dr Carrington found this specimen in the Guy's Hospital dissecting-room. He exhibited it at the Pathological Society last winter. I am indebted to him for allowing me to examine it. It was taken from the body of a woman aged 75.

This stomach (fig. 6) was rather small and thin-walled—the cardiac pouch being rather the more capacious.

The centre of the contraction was distant $2\frac{1}{2}$ inches from the cardiac orifice, and $4\frac{1}{2}$ from the pyloric, measured along the small curvature.

There was a slight patch of thickening in the latter position about $\frac{3}{4}$ths of an inch to the cardiac side of the contraction.

On examining its interior no definite scar could be detected at this spot; but here the mucous membrane was smooth and not so freely movable on the subjacent parts as elsewhere. No

other abnormal appearance, either externally or internally, could be made out. The stricture just admitted the thumb. Cardiac and pyloric orifices normal.

Dr Carrington considers that the thickenings in the three last cases may be due to the injected gastric arteries; but, independently of the fact that in at least two of the specimens the arteries had not been injected, the facts do not warrant such a supposition, for, as I have previously mentioned, in these cases of congenital contraction the arteries in this position are either non-existent or dwindled to the tiniest twigs.

Case VII.—No. 11·6B of the Physiological Series of St Bartholomew's Hospital Museum.

An inflated, dried stomach (fig. 7), of small size, divided into a cardiac and pyloric portion by a well-marked constriction, situated at a point 3¼ inches from the cardiac orifice, and 5¼ from the pyloric, measured along the small curvature. I judged the contraction large enough to admit the thumb and little finger. The pyloric division was much elongated, and as it approached the valve resembled a piece of small intestine. Its walls were of about normal thickness. On each side of the contraction, in the small curvature, about an inch apart, was a small darkish patch, of less size than a pea, probably the seat of some former lesion. The pyloric valve was very ill developed—forming a scarcely perceptible ring.

In the specimen next preceding this in the Museum (No. 11·5) I regard the contraction as pathological.

I am indebted to Mr Bowlby for allowing me to examine these specimens, and the succeeding one.

Case VIII.—A. 216 of the Teratological Series of St Bartholomew's Hospital Museum. This is the case recorded by Mr Morrant Baker in the *Transactions of the Pathological Society of London,* vol. xvii. p. 105. A dry stuffed specimen (fig. 8) the arteries of which had been injected: the separate arterial supply of each sac, and the other peculiarities I have mentioned, were nearly as obvious as in Case I.

In the catalogue it is described as—"A stomach, a narrow portion of which, nearly midway between the cardiac and pyloric orifices, is extremely contracted, so as to divide the organ into two compartments, which communicate only by a

small orifice. The stomach appears otherwise healthy. From a woman, aged 63, in the dissecting-room."

The organ was of rather large size—the pyloric pouch exceeding the cardiac in this respect. The walls were of about normal thickness throughout.

The contraction was of the annular variety, and presented no thickening, irregularity, or other sign of disease. It was distant 4 inches from the cardiac extremity and 7 inches from the pyloric, measured along the small curvature. The index finger could just pass through it.

No lesion could be detected in any part of the organ.

Case IX.—A wet specimen, No. 207 in St George's Hospital Museum, and presented by Dr Page.

A medium-sized stomach (fig. 9), having a well-marked contraction, about 1 inch long, the centre of which was distant from the cardiac orifice 3 inches and from the pyloric $4\frac{1}{2}$, measured along the small curvature. The pyloric division was considerably larger than the cardiac. In the neighbourhood of the contracted part the fibrous membrane was slightly opaque and thickened. Externally there was no other obvious lesion.

Each division had been opened, so that a good view of the interior could be obtained. On the cardiac side of the contraction, near the small curvature, at a distance of 1 inch and $1\frac{1}{2}$ inch respectively fromit, were two small superficial erosions. Otherwise the interior of the organ presented a perfectly normal appearance. There was no lesion in the pyloric pouch. The stricture admitted the little finger, and was itself quite free from disease.

In the catalogue it stated that—"When recent the mucous membrane was very vascular and in places blood was extravasated beneath it. The other organs were healthy. The specimen was removed from the body of a woman who for many years had suffered from nausea, vomiting after taking food, cough in winter, and dyspnœa. Two or three days before death she complained of tenderness at the epigastrium on pressure; and for forty-five hours previously she was delirious."

Case X.—There is a wax model of this specimen, by Professor Chaussier, in the Musée Dupuytren at Paris. The stomach, a rather large one, presented a marked contraction in the great curvature, at the junction of the great cul-de-sac with the body o

the organ. On its outer surface, at the top of the great cul-de-sac, was a small abrasion, where it had once probably been adherent to the under surface of the diaphragm. There was no other lesion.

I believe this list includes all the specimens of the kind contained in the Metropolitan Museums.[1]

Remarks on Congenital Contraction of the Stomach.

The old anatomists were aware of the occasional occurrence of contractions at about the middle of the stomach, and they attributed them for the most part to pathological causes.

Judging, however, from the confused and mixed-up descriptions of this peculiar deformity which appeared at that time, their knowledge of the subject was very vague and indefinite. The first well-recorded cases with which I am acquainted are to be found in Morgagni's stupendous work, *De Sedibus et Causis Morborum per Anatomen Indagatis*:[2] reference is there made to cases previously described by Blasius, Valsalva, Riolanus, and other authors of that period.

Monro[3] notices Morgagni's cases, and gives the chapter and verse of others by Lorry, Walter, Ludwig, Hufeland, and Van der Kolk.

Sir E. Home's[4] observations, on the shape and structure of the stomach in various animals and in man, threw additional light on the subject; but he failed to recognise the congenital nature of many of these contractions.

This was reserved for Professor Struthers,[5] who in a very interesting paper has recorded two cases of this nature. I am indebted to him for many valuable suggestions. These cases, together with those I have described, are the only ones of the kind of which I have been able to find anything like a complete

[1] Since this was written I have discovered another specimen in the Museum of the London Hospital (A^c 131). This specimen is particularly interesting, as, in addition to the well-marked hour-glass contraction, the stomach also presents contractions separating the great and small cul-de-sacs from the rest of the organ.

Dr Charlewood Turner, who has examined the specimen, has kindly informed me that it presents no trace of any ulcer, scar, or other lesion.

[2] *Vide Eng. Trans.*, Letter xvi. art. 38; xxvi. art. 31; xxx. art. 7; xxxvi. art. 3.

[3] *Lectures on Human Anatomy*, by Alex. Monro, jun., 1813, vol. ii. p. 111.

[4] *Lect. on Comp. Anat.*, also *Phil. Trans. Roy. Soc. Lond.*, 1807 and 1817.

[5] *Anat. and Physiol. Obs.*, art. on "Double Stomach."

record. Having visited the various metropolitan museums, I have discovered in them only six such specimens: the Hunterian Museum not containing a single example. Hence we may conclude that the affection is one of exceeding rarity; for it is hardly probable that a striking deformity of this kind, in an organ like the stomach, would escape unnoticed, even at the most casual *post-mortem* examination.

It is remarkable, however, that hitherto most of these specimens have come from the dissecting room. On studying their history, we are struck with the frequency with which the contracted stomach is the seat of lesion,—either ulcer or cicatrix. It was this no doubt that misled the older authors. May be there are some who still think as they did, that in such cases these contractions have a pathological origin.

A careful examination of the subject will, I think, lead to a different conclusion. It would be contrary to my own experience, and to that of the best observers, to deny the existence of stomach contractions due to ulceration and its results. The museum of St Thomas's Hospital is particularly rich in specimens illustrative of this fact. The question is how to distinguish one kind of contraction from the other. I believe this may be readily done by paying attention to the following facts:— The congenital contractions, however long and narrow they may be, and they are generally longer and narrower than those of the other form, present both externally and internally a perfectly smooth and normal appearance; whereas the pathological ones are irregular and puckered, with thickened cord-like rugosities radiating from the seat of disease.

Again, the situation in which these contractions are so uniformly found, viz., nearer the cardiac than the pyloric extremity, is not that generally affected by gastric ulcers, which, as Rokitansky[1] has remarked, are usually seated in the middle zone of the pyloric half of the stomach. It should be remembered also, that although ulceration occasionally leads to contraction, such an occurrence is quite exceptional.

When, however, this result does ensue, the contraction is always situated in the plane of the lesion. In this respect then, such contractions differ markedly from those of a congenital nature

[1] *Manual of Pathological Anatomy*, Syd. Soc. Transl., vol. ii. pp. 23 and 24.

associated with ulceration; for in the latter no contraction is to be found in the plane of the lesion, and no lesion in the plane of the contraction.

Thus, in every one of my cases I found the whole length of the contracted area perfectly free from any sign of disease. Such lesions as existed were situated in the neighbourhood of the small curvature, either on the cardiac or pyloric side of the contraction, not unfrequently in both places; in the latter circumstance the intervening contracted portion, an inch or an inch and a half in length, was perfectly healthy in every case.

I submit that these appearances only admit of one explanation, namely, that the lesions were really caused by, and were secondary to, the contractions.

Against their congenital origin, it may be urged that no examples of this deformity have as yet been discovered in young children, at least I am not aware of any; nor is this surprising, considering the rarity of the affection and the infrequency of *post-mortem* examinations at that age. Morgagni,[1] however, mentions a remarkable case in which symptoms of this affection appeared at birth, and were hereditary in three successive generations. Hence I think too much importance should not be attached to this purely negative objection.

The greater relative frequency of these contractions in women, and their apparent absence in infants, led Sœmmering to attribute them to pressure of the stays. But if this were the case they would be of common occurrence in that sex, which is not the case; besides, they are met with also in men.

Other lesions besides those resulting from ulceration may, no doubt, in very exceptional circumstances, give rise to hour-glass contraction of the stomach. No. 11·5 of the Physiological Series of the Museum of St Bartholomew's Hospital is a case in point. It is classed with a specimen of congenital contraction, which it much resembles, and is described in the catalogue as an example of the form which the stomach assumes during the later period of digestion. Mr Bowlby, the curator, kindly allowed me to make a thorough examination of it. At the middle of the organ was a smooth-looking contraction, 2½ inches long, and about the size of a man's thumb. The contracted part felt perfectly solid; and

[1] *Op. cit.*, Exp. xxx. art. 7.

at this place its walls were greatly hypertrophied. Internally no lesion could be detected; but the mucous membrane at the contracted part presented numerous longitudinal lamelliform rugæ closely pressed together. Microscopical examination of a section of the thickened wall revealed what I believe to be an early stage of cancerous infiltration, but in this particular Mr Bowlby does not agree with me.

Having thus established the congenital nature of these contractions, it may be interesting to inquire whether they have any counterpart in the normal condition of the stomach.

The occurrence of slight contractions at certain definite situations in the normal stomach has been generally overlooked; although such contractions may frequently be seen.

Home[1] regarded the human stomach, like that of many animals, as naturally the seat of such a contraction at about its middle; though he failed to detect any increased development of the muscular fibres at this spot.

Most anatomists admit a slight contraction a little to the left of the pylorus, and one has occasionally been observed separating the great cul-de-sac from the body of the stomach.

On this subject Cruveilhier[2] remarks:—"At about an inch from the pylorus the stomach is markedly flexed on itself, forming a very pronounced bend, *coude de l'estomac*, and presenting a pouch on the side of the great curvature, with a corresponding internal excavation, described by Willis as the antrum pylori, and by others as the small cul-de-sac or small tuberosity of the stomach. It is not rare to see a second pouch beside the first, and a third smaller one, on the side of the small curvature, owing to the bend which the stomach takes. These pouches, hardly perceptible in many subjects before insufflation, are rendered very distinct, and even in some cases very considerable, by distension."

Henle, in his treatise on Anatomy, says:—"The antrum pylori is separated from the rest of the stomach by a contraction near the pylorus, more marked on the upper than on the under surface. A second contraction is rarely found at the middle of the stomach, which divides it into a right and left half."

[1] *Phil. Trans. Roy. Soc. Lond.*, 1807, p. 170.

[2] *Anatomie Descriptive*, tome ii., ed. 1834, p. 463.

Such are the opinions of these authors, from which, together with my own observations, I conclude that the human stomach is naturally divided by three contractions into four compartments, viz., one at each extremity, the small cul-de-sac and the great cul-de-sac; and an intermediate portion, subdivided by a contraction at about its middle, into a cardiac and pyloric portion, this last contraction being, as a rule, less obvious than the others.

Careful examination of a considerable number of congenitally contracted stomachs has revealed the interesting fact, that such contractions do not occur just anywhere, but only in certain definite situations, which are identical with those occupied by the normal contractions.

As my cases testify, the commonest seat of such abnormal contractions is at about the middle of the organ. In two of Morgagni's [1] four cases the contraction was in this situation: in the other two it occupied such a position as to separate the antrum pylori from the rest of the stomach.

Rokitansky [2] remarks:—"Among the abnormalities of the human stomach, we reckon first all those rare congenital malformations, in which an annular contraction divides the organ into a cardiac and pyloric portion, or in which two or three such contractions form three or four sacculated divisions, and thus cause in these a resemblance to the stomach of ruminants. We distinguish such from the contractions produced during the agony of death, by the fact that the latter may be removed by inflating the stomach."

Brinton [3] says:—"These transverse subdivisions of the tube may possibly imply a mere arrest of development in the site of imperfect septa."

In Luton's [4] opinion this anomaly resembles the multiple stomachs of ruminants, especially of the cetaceous herbivora. With these ideas he cites the example recorded by Billard of a stomach whose mucous membrane resembled in appearance that of the reticulum of a ruminant, and bristled with long villosities.

[1] *Op. cit.*

[2] *Op. cit.*, vol. ii. p. 30.

[3] Todd's *Encyclopædia of Anat. and Physiol.*, art. "Stomach," &c., in the Supplement.

[4] *Nouveau dict. de med. et de Chir. prat.*, art. "Estomac."

In one of my cases he contraction was so situated as to divide the great cul-de-sac from the rest of the stomach.

Cruveilhier,[1] Handfield Jones,[2] Leube,[3] and other author allude to these contractions in similar terms.

It is interesting to notice the occurrence of various *temporary* contractions in precisely the same localities as these congenital ones; and, like them, commonest at about the middle of the organ. Home[4] thought the human stomach naturally presented a temporary contraction of this kind during the process of digestion; he pointed out that the bilocular form of stomach is not unfrequently met with in bodies examined immediately after death, and in such as have met with sudden death during the process of digestion.

Dr Struthers[5] fixed the usual locality of this contraction at 4 or 5 inches to the left of the pylorus.

A remarkable case of temporary contraction was recorded some years ago by M. Broca:[6] the specimen was obtained from the body of a female criminal who had been executed. The great cul-de-sac presented a spherical dilatation, succeeded by a contraction. Setting out from this point the stomach was uniformly narrowed, but another contraction occurred before the pylorus was reached, so that the organ resembled somewhat a portion of large intestine. Here there was an appearance of three stomachs. "This specimen," said M. Broca, "is also of interest, because it has much analogy to another which I met with in a male criminal who was executed, and of which I am now able to show you the drawing. With regard to contraction of the stomach, internal to the great cul-de-sac, we can easily conceive how it might be produced. The longitudinal fibres of the stomach, prolonged below the great cul-de-sac, form a loop, which, in contracting, would produce such a result." The literature of the subject reveals several other cases of a similar description. In accordance with the above facts, I think we may regard the occurrence of temporary and permanent contrac-

[1] *Op. cit.*, tome ii. ed. 1834, pp. 457–8.

[2] *Manual of Path. Anat.*, p. 494.

[3] Ziemssen's *Encyclopædia*, art. "Stomach."

[4] *Lect. on Comp. Anat.*, vol. ii. fig. xii. and context; also *Phil. Trans. Roy. Soc. Lond.*, 1807, pp. 157, 170 and 171, 1807–1817, p. 350.

[5] *Op. cit.*

[6] *Bulletin de la Soc. Anat.*, t. xxvi., 1851, p. 30.

tions, dividing the stomach into two, three, or four portions, as due to exaggeration of the slight contractions normally existing in these situations.

Whether the human gastric mucous membrane presents structural differences, corresponding to these subdivisions, is at present an open question.

That of the dog and some other animals has been found to possess in the cardiac region only peptic glands, and in the pyloric only mucous ones. In these animals Ebstein has described a so-called intermediary zone, in which the two kinds of glands are not only mixed, but present also important structural modifications. Heidenhain has shown, by isolating various segments of the organ, that the fluid secreted by one part differs from that secreted by another.

With regard to the human stomach, however, most observers have not ventured beyond the vague foreshadowing of somewhat similar distinctions.

Cruveilhier,[1] however, with his usual perspicacity, has pointed out several differences obvious to the naked eye. Thus he says:— "There is one fact to which too much importance cannot be attached, and that is the difference in the appearance of the mucous membrane of the great tuberosity of the stomach, and of the part situated to the right of the œsophagus. Sometimes the line of demarcation forms a perfect circle; and this is very remarkable, because in man, who has a single stomach, it may be regarded as a rudiment of the division into the compound stomachs found in the lower animals: for a multiple stomach results rather from some difference in the structure of the mucous membrane than from the existence of different compartments or distinct cavities."

In another place [2] he describes the mucous membrane of the pyloric region, as differing from that of the cardiac, in presenting frequently a granular aspect, similar to that seen in the stomach of the pig.

Disease, he says,[3] often respects the line of demarcation existing between these two portions. In confirmation of this state-

[1] *Op. cit.*, t. ii., pp. 473–4–8 ; *vide* also his remarks with regard to bilocular stomachs, *ibid.*, pp. 457–8.

[2] *Op. cit.*, t. ii. p. 473.

[3] *Op. cit.*, t. ii. p. 475.

ment Dr Philip[1] has recorded the case of a woman who ate and digested her food perfectly to the last; but whose stomach was found, after death, to be ulcerated everywhere, except at the cardiac end.

Taken in conjunction with the remarkable proneness of the cardiac pouch to *post-mortem* digestion, as described by John Hunter, the above fact tends to confirm Home's opinion that this region is the exclusive seat of the peptic glands.

The mucous membrane here is thinner, softer, and more vascular than in other parts of the stomach, and it is more firmly adherent to the subjacent structures, so that it can only be separated with difficulty, and it generally comes off in shreds; whereas that lining the rest of the organ is loosely attached, and can easily be separated entire.

The development attained by this part of the stomach is subject to many variations.

Cruveilhier says:[2]—"It is almost entirely absent in the carnivora, very large in the herbivora, and of medium size in man. Its size varies much in different individuals. I have seen human stomachs in which the great cul-de-sac did not exceed in size that of the carnivora."

Meckel relates having seen this part of the organ absent, and replaced, as it were, by an exaggerated development of the small cul-de-sac.

Todd and Bowman remark:[3]—"We have suspected that the digestive power of the two parts must differ, that the office of the pyloric tube resembles that of the stomach cells generally and is different from that of the true stomach tube, that perhaps the acid product of the stomach may be furnished by one rather than the other. We confess, however, that we have been unable, on the one hand, to obtain stomachs sufficiently fresh and healthy to test the fact of the anatomical distinctness of the two regions in man, or, on the other, to ascertain the value of the conjectures just alluded to, as applied to animals in which the twofold structure is certain.

No one has expressed this view more forcibly and with greater

[1] *An Experimental Enquiry into the Laws of Vital Functions*, ed. 1817.

[2] *Op. cit.*, t. ii. p. 462.

[3] *Physiological Anatomy*, ed. 1856, vol. ii. p. 195

clearness than Dr Draper.[1] He says, after reviewing the structure of the stomach in different animals :—"So far from there being anything in contradiction to the doctrine that different portions of the digestive surface of the mucous membrane of the stomach are devoted to different duties, there is strong evidence in support of its truth, derived partly from the instances furnished by comparative anatomy, and partly from the anatomical structure of the gastric mucous membrane. The four separate digesting chambers of the herbivora are merely an elaboration of the structure which is presented by the apparently homogeneous mucous surface in man. But that this mucous surface is in reality heterogeneous, and in different regions possesses different powers, is shown by the fact that at one part it presents mucous follicles, at another peptic follicles, at another follicles for secretion of hydrochloric acid. As we approach towards the pylorus, the existence of a new function is betrayed by the appearance of a new mechanism—the villi—which have been so well studied by Dr Neill ; and this is even indicated externally, as shown in the accompanying diagram, where the lesser tuberosity of the stomach is separated from the rest of the organ by a well-marked constriction, showing, according to Professor Retzius, that the antrum pylori of the older anatomists is really a special compartment of the general cavity. This part of the stomach is distinguished by the greater thickness of its muscular coat, the more copious glandular development, and the presence of the well-known plicæ fimbriatæ.

The commencement of the duodenum also forms a special rounded cavity, which Professor Retzius proposes to name antrum duodeni, characterised internally by the absence of valvulæ conniventes and the dense array of Brunner's glands beneath its mucous membrane. This part constitutes what has been called the fourth stomach of the porpoise and of some other cetaceans."[2]

As to whether any such structural differences existed in my

[1] *Physiology*, 2nd ed. 1861, pp. 60-61.

[2] In this connection such cases as that recorded by Dr Goodhart a few years ago in the *Transactions of the Pathological Society*, in which the upper part of the duodenum was almost completely separated from the rest by a congenital contraction, are of interest. I have since seen a fœtus in which these parts of the duodenum were completely separated—each ending in a cul-de-sac.

specimens of contracted stomach I am unable to state, since they were too old for such particulars to be satisfactorily ascertained either with the naked eye or the microscope. From such examinations as circumstances permitted nothing of the kind was observed.

Notwithstanding what has been said of the analogy of the human type of stomach to that of ruminants, rodents, and other herbivora, there is one important difference between them, to which sufficient attention has not been paid.

I allude to the direct passage of the food in the former, from the gullet, into the true digestive, glandular, or cardiac division of the stomach, and its subsequent escape into the mucous, muscular, or pyloric division: an arrangement just the converse of that observed in the latter. In this particular, the human type of stomach appears to resemble somewhat that of birds rather than ruminants; unless indeed the crop of birds is regarded as analogous, not to the cardiac portion of the human organ, but to the œsophageal dilatations which form the chief part of the ruminant stomach—a view which, I believe, is not generally entertained, though it seems to me not altogether improbable.

Lastly, it remains to inquire what relation, if any, these contractions bear to the alterations in shape which the stomach undergoes during the process of natural digestion. In the bodies of human beings and of various animals, examined very soon after death, especially after sudden death during the process of digestion, as previously mentioned, Home frequently found hour-glass contractions of the stomach; but he was unable to detect, in the human stomach, any increased development of the muscular fibres in this situation, similar to what he had observed in dogs, &c. He concluded that this contraction resulted from the natural action of the organ during digestion, and that it served to maintain the more solid and undigested portions of food in the cardiac pouch, allowing only the more fluid and digested portions to escape into the pyloric division, thence to be propelled into the duodenum.

The existence of this contraction has been denied by some authors. Müller[1] says:—"The central constriction, of which the

[1] *Vide* his *Physiology*, English trans., vol. i. p. 504.

stomach was by Sir E. Home imagined to be the seat during digestion, has never been really observed. Neither Tiedemann nor I have seen anything of the kind in dogs." The concurrent testimony of subsequent observers is, however, against the accuracy of this statement. Brinton[1] is very explicit on this point. In his complete and graphic account of the movements of the stomach during digestion, as he observed them in the dog, he distinctly states that he witnessed this hour-glass contraction. Like Home, he failed to detect in the human stomach any increased development of the muscular fibres at this spot. Referring to the so-called transverse band described by Spallanzani and Haller, he says :—"Anatomy fails to recognise a distinct band or even any exaggeration of the ordinary circular fibres sufficient to merit separate description."

Beaumont's[2] observations on the celebrated Alexis St. Martin, clearly prove the existence during digestion of such a contraction in the human stomach. He says :—" In attempting to pass a long glass thermometer tube through the aperture into the pyloric portion of the stomach, during the later stages of digestion, a forcible contraction is first experienced at this point (*i.e.*, 3 or 4 inches from the smaller end), and the bulb is stopped. In a short time there is a gentle relaxation, when the bulb passes without difficulty, and appears to be drawn, quite forcibly, for 3 or 4 inches, towards the pyloric end. This ceases as soon as the relaxation occurs, and the tube rises again of its own accord 3 or 4 inches, when the bulb seems to be obstructed from rising further ; but if pulled up an inch or two, it moves freely in all directions in the cardiac portion."

All observers agree in describing the movements of the stomach during digestion as very different in its cardiac and pyloric portions ; and this difference coincides with the varied distribution of the muscular fibres. Thus in the cardiac division, where they are only slightly developed, the movements are scarcely perceptible, whilst in the pyloric division, where they are very abundant, forcible movements occur.

[1] Lectures in *Med. Gazette*, 1849, Lect. on "Diseases of Stomach," ed. 1864 pp 10–12 ; also article "Stomach," &c., Todd's *Encyclopædia of Anat. and Physiol.*, in the Supplement.

[2] *Experiments and Observations on the Gastric Juice*, ed. 1838, pp. 101–105

It is evident therefore that during digestion the human stomach is the seat of a contraction at about its middle, which corresponds in position with the temporary and permanent hour-glass contractions of the organ to which we have previously alluded.

Whether similar contractions occur in other situations, during the natural action of the organ, corresponding to those occasionally met with after death, is at present uncertain. I have found no mention made of such contractions by those who have investigated the subject; but from the curious forms of temporary contraction with which we are familiar, I am disposed to regard their occurrence as extremely probable.

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