

loma, and "peculiar bleeding tumor." These tumors are very rare, have the feel of a large warty polypus, with cauliflower surface, are of red color, bleed easily when touched, and are of relatively slow growth. They adhere to the rectum by a pedicle, sometimes composed chiefly of mucous membrane, and at other times large, short, and fleshy. The pedicle may be absent and the growth will vary in structure according to the proportions of its different elements. It may reach the size of an orange, is found only in adults, and the symptoms are the same as those caused by other polypi.

The hard or fibrous polypus (sarcomatous polypus), which is composed primarily of the elements of the submucous connective tissue, is much rarer than the soft variety, and is most commonly found in adults, in whom it may be single or multiple. It is composed chiefly of fibrous tissue, and resembles the uterine fibroid; but it may contain both muscular and glandular elements. These polypi vary greatly in the degree of hardness to the touch, according to their composition and turgescence. They may creak under the knife on section and look very much like hypertrophied and oedematous skin; or they may resemble the better known nasal polypus in composition. When they are seen in the rectum before removal the surface is generally red from vascularity; but after removal they are pale and generally smooth, though sometimes uneven and irregular in surface and covered with hypertrophied papillae. The mucous membrane is generally easily stripped off, unless there has been local inflammatory action, in which case it may be firmly attached and have lost its natural appearance. The vascular supply is abundant, both in the substance and on the surface of the tumor. The pedicle is generally slight, and is formed mechanically by the traction of the growth. The tumor is benign in character, and when once removed does not generally return, although cases of recurrence at or near the same point are not unknown.

A rectal polypus may exist many years and give no signs of its presence. The two chief symptoms which it is apt to excite are hemorrhage and discharge. The former may be of daily occurrence, or may be present only at long intervals, and it may vary in amount from a few drops to a quantity which shall cause grave disturbance and alarm. When the mucous membrane covering the tumor has once become ulcerated, the bleeding will be frequent and the discharge more or less fetid. When the tumor is so high and the pedicle so short as to be beyond the grasp of the sphincter, there will be little or no pain; but after prolapse once begins to occur, the suffering at each act of defecation may be extreme. The sphincter may become dilated and relaxed, or if it remain strong it may work a spontaneous cure by strangulating the pedicle. The discharge is sometimes profuse and constant, escaping not only at the times of defecation, but at frequent intervals between, and being of an exceedingly fetid character. This by its irritation may set up secondary troubles—congestion of the mucous membrane, erosions around the anus, vegetations, diarrhoea, and tenesmus; and joined with the loss of blood the condition may be mistaken for extensive ulceration or malignant disease.

The treatment is generally simple. When the pedicle is long and slender the tumor may as a rule be safely twisted off, but it is better to apply a ligature. There are two dangers to be considered: the first is that the pedicle may contain large vessels, and the other is that it may contain peritoneum. The extirpation of a polypus which came down from the sigmoid flexure and dragged the peritoneum with it has been followed by death. Should there be a large, fleshy pedicle it must be securely ligatured.

The anus and adjacent skin are often the seat of vegetations of a warty or papillomatous nature, due to a simple hypertrophy of the papillary layer of the skin. They are composed of the connective tissue, the epithelial covering, and the blood-vessels, which in their natural proportions and quantities make up the papillae of the derma. These little tumors resemble ordinary warts.

When one of them is isolated it is dry, but when several of them are united they become macerated in the secretion of the part; this secretion undergoing decomposition in the spaces between them, and then giving rise to inflammatory phenomena. The tumor then becomes moist and fetid, and all the adjacent parts become irritated. According to the number and size of the warts, the condition of the patient, the abundance of the secretions, and the irritation to which they are originally due, these vegetations take on various shapes, and hence have been described as cock's-combs, cauliflower excrescences, etc., but the fundamental structure of all of them is the same. They were formerly considered as proof positive of syphilis, and even of sodomy, and were so treated; but they have nothing to do with syphilis, and they owe their growth, in the first place, to a special predisposition to the formation of warts in the individual, and, in the second place, to the presence of some irritating cause acting on this particular part. Thus the discharge from any disease of the rectum or genitals may cause them to grow, and they may appear in persons apparently perfectly healthy and cleanly. Pregnancy has an undoubted influence on their production, and they may disappear spontaneously after delivery. They may appear at any age from infancy to adult life, though generally belonging to the latter. They may vary in size and quantity, from a single enlarged papilla to a mass weighing a pound. When they grow from one side of the intergluteal fold, and are large enough to press with their moistened surface upon the corresponding point on the opposite side, a second patch may be developed at the point of contact. Their development may be slow or rapid, and when they reach a large size the patient is troubled by the feeling of a foreign body, by a sanious and foul discharge, and by fresh erosions and superficial ulcers in adjacent parts. Great pain in defecation may be caused by a small wart just at the verge of the anus, and such a little tumor may cause all the symptoms characteristic of fissure. These warts may also spring entirely from the mucous membrane above the sphincter. There is little danger of mistaking a mass of such warts for a malignant growth, though they have been known to assume a semi-malignant character, and to return frequently after removal. The most common error is to consider them as syphilitic condylomata, and indeed they may not always be easily distinguishable from the raised mucous patch or flat condyloma which is a manifestation of true syphilis. The two may exist simultaneously, the former caused by the irritation of the latter.

The surest, most rapid, and in every way most satisfactory method of curing these warts is simply to cut them off with the knife or scissors. The ligature is not always applicable, and cauterization is apt to do more than is necessary. The growths may, however, be induced to dry up and shrivel away by applications of powdered alum or tannin, and by washing with astringent lotions, such as Labarraque's solution.

The term condyloma has been applied to so many different growths around the anus that it has lost all definiteness. The variety of syphilitic mucous patch situated upon the skin near the anus, and known as condyloma lata, or vegetating condyloma, first manifests itself as a red spot, and by a slight effusion beneath the epidermis, which is soon rubbed off by friction, exposing a raw surface generally covered by a grayish pellicle. This surface is subsequently elevated by an upward growth, and by branching of the papillae, with formation of connective tissue and dilatation of the blood-vessels. Where this process has reached a considerable extent, a cauliflower appearance is the result, and what was at first a simple mucous patch may become a large, pedunculated, warty growth surrounded by other vegetations which have sprung up around the original lesion, and which are due to the irritation of its presence.

The more general meaning of the word condyloma is, however, a non-syphilitic tumor composed of an hypertrophy of the skin around the anus, attached by a broad base, pinkish in color, soft, fleshy, glistening, moist,

irregular in shape, flattened where two are pressed together, and generally giving out a slight secretion. These tumors, as a rule, have one of the radiating folds of the anus as their point of departure, and they differ from the warty growths in the fact that they consist of an hypertrophy of the whole thickness of the skin and not alone of the papillae. The epithelial element in them is not as marked as in the warts, and the blood-vessels also are less developed. They are merely the result of a localized chronic inflammation of the skin, and often result from an external hemorrhoid or any local irritation, such as has already been spoken of. They are a very common accompaniment of any ulcerative process within the rectum, and hence of stricture, and many a stricture has been unjustly stamped as syphilitic because the discharge from the anus has caused the development of these fleshy tags. Unless there is some special reason for interfering with them they may generally be left to themselves, as they are not likely to cause any amount of trouble unless they become ulcerated upon the surface. In this case they are easily removed by the scissors and ligature.

PRURITUS ANI.—Itching at the anus is generally a symptom of some other disease, such as hemorrhoids or eczema, but it is often present in a marked degree when no cause for its existence can be discovered. It is at times an exceedingly painful and annoying affection, which seems to be dependent upon no particular general state, being found in all classes. The itching is more or less constant, but is generally worse after the patient has become warm in bed for the night. The scratching which is indulged in for relief, often unconsciously during sleep, aggravates the condition by lacerating the skin. The disease is sometimes, in old cases, attended by marked changes in the appearance of the parts. The skin becomes thickened and parchment-like, or else eczematous and moist from exudation, and there may be a very characteristic loss of pigment, in which case the skin becomes of a dull whitish color. This is particularly noticeable in cases of long standing. Associated with this condition it is not unusual to find one or several fissures.

The causes of pruritus are sometimes easily discoverable, and in such cases a cure rapidly follows their removal. It is often due to internal hemorrhoids, and will be effectually cured by their removal. It is often a symptom and complication of a fistula with a small external opening, which is easily overlooked and may be relieved by the cure of the latter and the cessation of the discharge. It is often dependent upon the presence of worms in the rectum, and in every case these should be carefully looked for. When they exist they may generally be seen like small pieces of fine, white thread lying between the radiating folds at the verge of the anus, especially at night after the itching has begun. Instead of the disease being due to a parasite within the rectum it is sometimes easily accounted for by the presence of pediculi. Again, pruritus of an intense kind may be due to *eczema marginatum*, or it may be a symptom of a chronic eczema, of herpes, or of erythema. When no local cause can be discovered, a careful inquiry must be made into the patient's general health and habits. If chronic constipation be present it must be overcome first of all. In women the condition of the generative organs must be looked after, and the urine should be examined for sugar.

In case none of these causes can be found to account for the symptom, errors of diet must be searched for and corrected. Anything like excess in smoking or in the use of alcohol will aggravate the disease, and these habits if indulged in at all must be carefully regulated. The disease will sometimes be encountered in stout, full-blooded persons who live well, and perhaps incline to gout. In such, active exercise and plainer living, with cold bathing of the part night and morning, and the use of a wash containing tar or carbolic acid, will often effect a speedy cure. On the other hand, the disease may be present in persons of exactly the opposite class, the overworked and worried professional or business man, and in this class of cases alone, where the itching seems to be a purely nervous affection, arsenic is indicated. It may be combined

with quinine and cod-liver oil, and administered until its full physiological effects are manifested. If pin-worms are the cause, they may generally be removed by certain simple measures, the best known of which is an enema of lime water or carbolic acid, ℥i.; glycerin, ℥i.; and water, ℥vij., injected after each passage. Turpentine and tincture of iron used in the same way are very effectual. The most useful remedy for eczema marginatum is a wash of equal parts of sulphurous acid and water, frequently applied with a soft cloth, and, when necessary, gradually increased in strength up to the pure acid, which is, however, a painful application and one which will readily blister. Strong tincture of iodine, thoroughly applied, is also an effectual application. If there be thickening of the skin from effusion, the application of very hot water freely with a sponge may give relief, and if a stronger application be necessary, the compound tincture of green soap, or a solution of caustic potash (gr. v. to ℥i.), or liquor potassæ, may be resorted to. A good ointment is made of the ordinary oxide of zinc ointment made soft and applied gently; and one which is very effectual in temporarily allaying the itching is made of chloroform (℥i. to ℥i.). Another effectual application is composed of carbolic acid, ℥ss.; glycerin, ℥i.; and water, ℥iij. This may be applied at night, and its strength may be adapted to the case. There are many formulae of this kind, all of which answer a good purpose, but the cure is to be undertaken in a broader spirit than by searching for any single ointment or lotion which shall allay the itching for a time. In every case the cause must be found and removed if a permanent cure is to be expected.

SPASM OF THE SPHINCTER.—This is an affection which has been much disputed about, but which undoubtedly sometimes exists alone, and without any complicating fissure. It is generally found in nervous and debilitated patients, and its symptoms are: more or less uneasiness about the anus, a sense of fulness in the perineum, often more or less difficulty in micturition, constipation, and pain and difficulty in defecation. A digital examination will often show a markedly contracted anus, and an attempt to introduce the finger will cause unbearable agony. The act of defecation may be exceedingly difficult to accomplish on account of the pain it causes; and any anxiety or distress of mind, and anything which tends to irritate the rectum or the parts around, will aggravate the difficulty. The treatment consists in attention to the general health, in allaying nervous excitement, in the administration of laxatives to relieve the bowels, and in anodyne injections, such as twenty drops of laudanum. The surgical treatment consists in etherization and thorough dilatation of the sphincter. If this cannot be done, the next best thing is the systematic use of bougies.

NEURALGIA.—This is an affection which, like the last, is most often seen in nervous people, particularly women. The pain is apt to be paroxysmal but may be continuous, and, unlike spasm, is entirely independent of the act of defecation. It is much the same disease as neuralgia elsewhere in the body, and must be treated in the same general way. Where there is well-marked periodicity a malarial element must be looked for; and the disease is sometimes the only manifestation of the gouty diathesis. The first care should be for the general health, the second for the regularity of the bowels; and, after this, local applications of cold water and of an ointment of belladonna should be tried. Sometimes blisters applied over the sacrum afford relief. The disease must be carefully distinguished from coccygodynia and from spasm of the sphincter.

Charles B. Kelsey.

ANUSOL.—A proprietary name for suppositories stated to contain bismuth iodo-resorcin sulfonic acid. A formula which has been published says that they contain balsam of Peru, zinc oxide, resorcin, bismuth oxyiodide, and cacao butter. They are used for catarrh of the rectum, tenesmus, anal fissure, pruritus, etc. W. A. Bastedo.

ANYTIN is a derivative of ichthyol introduced by Unna in dermatological practice. It is a thirty-three-per-cent.

aqueous solution of sulpho-ichthyolic acid and the aromatic, oily sulpho-compound contained in ichthyol. Dark brown in color, it contains 16.5 per cent. of sulphur and 4.5 per cent. of ammonium. It is decomposed by acids and strong alkalis, and possesses the peculiar property of rendering such substances as phenol, guaiacol, cresol, camphor, etc., freely soluble in water. These solutions are called "anytols" and promise to be valuable additions to our antiseptic materia medica. Koelzer used a 7.5-per cent. aqueous solution of metacresol anytol (metacresol, forty per cent.) in erysipelas. By painting it on frequently over an area extending somewhat beyond the inflammation he obtained a good result in every case. These anytols, especially those of phenol and cresol, may be used in five to ten per cent. dilution for disinfection of the hands or for vaginal or intra-uterine douches. They then have much the same effect as creolin.

Anytin itself is capable of setting up an active dermatitis, but diluted to ten per cent. it is very useful in chronic eczema, sunburn, and ivy poisoning. Like ichthyol, it will probably be used internally as an intestinal or respiratory antiseptic. It is stated to be directly antagonistic to the diphtheria bacillus.

W. A. Bastedo.

AORTA (Latin).—Greek, *ἀορτή*, from *ἀείρειν*, to lift, to carry; French, *aorte*, *grosse artère*; German, *Aorta*, *grosse Schlagader*.

SYNONYMS.—*Arteria magna* (Harvey); *hæmal axis* (Owen). Originally, in the plural, *aortæ* (*ἀορται*), the bronchial tubes (Hippocrates).

DEFINITION.—The main trunk (single in mammals and birds, double in cephalopods and most reptiles, triple in the crustaceans) of the systemic arterial system,* by means of which the oxygenized blood is carried to all parts of the body.

EMBRYOLOGY.—According to Gibson, "the single median tube," which is seen at one stage in the development of the vascular apparatus, begins to pulsate before the appearance of either muscular or nervous elements. "The heart movements must be due to some as yet unknown indwelling property of the embryonic heart tissue." In the development of the embryo there are two primitive aortæ. These unite early, and to them four lateral pairs are successively added, and all develop into the artery seen at birth—the aorta and its branches.

ANATOMY.—The aorta, although the main arterial trunk, is at its commencement generally a little smaller than the pulmonary artery, but in the aged it is usually slightly larger than that vessel. Its position, like that of other arteries, is protected in proportion to its importance. It takes its origin from the upper part of the left ventricle, extending upward and to the left for a short distance; then curving over the root of the left lung, it descends in front of the spinal column, passing through the aortic opening, *hiatus aorticus*, which is in the middle line behind the diaphragm, and which also transmits the vena azygos major, the thoracic duct, and occasionally the left sympathetic nerve. The vessel descends to the left side of the fourth lumbar vertebra, where it terminates, dividing into the right and left common iliac arteries. In its course it gradually decreases in size from 28 to 17 mm., giving off at different points branches of varying calibre. Quain divides this artery into the *ascending aorta*, the part within the pericardium; the *arch*, that part extending backward from the pericardial limit to the spine at the lower margin of the fourth dorsal vertebra; the *descending thoracic aorta*, from this point to the diaphragm; and the *abdominal aorta*, the part below the diaphragm. This method of division is founded on the fact that the first part is intrapericardial and has its origin from the fetal aortic bulb; while the third part of that section, which was formerly known as the *arch*, does not differ in relation, direction, or origin from the rest of the descending portion. The older anatomists treated the arch as consisting of three parts—the ascending, transverse, and descend-

* Foster's Encyclopædic Medical Dictionary.

ing, and comprising that part of the artery found between its ventricular origin and the lower border of the fifth dorsal vertebra. This latter division seems far less logical than the former according to the reasons just given. The first parts of both the aorta and the pulmonary artery are regarded embryologically as parts of the heart.

ASCENDING AORTA.—The ascending aorta springs from the upper and fore part of the left ventricle on a level with the lower border of the third costal cartilage behind the left half of the sternum. It passes upward, forward, and to the right in a line with the heart's axis till it reaches the upper border of the sternum, at which point its direction changes and the arch begins. The ascending aorta measures about two inches or two inches and a quarter in length, and it curves upward, backward, and to the left. Just above its origin this part of the aorta shows externally three small dilatations of about the same size, known as the *sinuses of the aorta* or *sinuses of Valsalva*. One of these sinuses is anterior, the other two posterior. The anterior and left posterior give origin to the two coronary arteries of the heart. Opposite to these three sinuses are the semilunar valves. A cross section of the vessel at this point is rather triangular in form, while below the valves it is circular. At the commencement of the arch and along the right side of the ascending aorta there is generally found another bulging, the *great sinus of the aorta*. Now and then this sinus is not present. It is seen more distinctly in the aged. The fibrous pericardium embraces the whole length of the ascending aorta, while a tube of serous membrane extends up from the cardiac surface to invest this vessel together with the pulmonary artery, except where they are in contact with each other.

RELATIONS.—At its commencement the ascending aorta is covered anteriorly by the pulmonary artery and the right auricular appendix. Higher up, the directions of these vessels diverge, the aorta passing forward and to the right and the pulmonary artery backward and to the left. At this point the aorta closely approaches the sternum, being separated from it, however, by the pericardium, the right pleura, the narrow part of the anterior mediastinum, the anterior edge of the right lung, besides a little fat and areolar tissue, as well as the remains of the thymus gland. Posteriorly are the left cardiac auricle and the right pulmonary artery. At its right are the right auricle and the superior vena cava. On the left is the main pulmonary artery.

BRANCHES.—The ascending aorta has two branches only, the right and left coronary arteries. These vessels, relatively small, spring generally from that part of the vessel which is just above the free margin of the semilunar valves, in the upper part of the two sinuses of Valsalva, and they supply the heart. The right coronary artery is about the size of a crow's quill, while the left is somewhat larger.

VARIETIES.—The ascending aorta and pulmonary artery may be transposed, *i. e.*, the former may arise from the right ventricle and the pulmonary artery from the left. There may be a communication between these two arteries by abnormal openings. One may be wholly or partly obliterated, while the other serves as a passageway for the blood of both by means of communications between them. There is now and then seen one simple tube connected with a simple heart like that in fishes. Sometimes the coronary vessels arise by a common trunk, or at times from the same sinus of Valsalva. As many as four arteries have been observed, in which case the supplementary vessels are smaller than normal and play the part of branches of the main coronary trunk, near which they take their origin. An extra coronary has even had its origin in the pulmonary artery. When one of the arteries is unusually small, the other is correspondingly large and supplies a greater area, especially at the back of the heart.

ARCH OF THE AORTA.—The arch or transverse aorta begins at the upper margin of the second right costal cartilage at the right border of the sternum and arches around the trachea, in its course passing upward, backward, and to the left of the body of the fourth dorsal vertebra. At this point it passes downward, and at the

inferior margin of this vertebra the thoracic aorta begins. The arch at its superior border is generally about an inch below the upper margin of the sternum in the median plane.

RELATIONS.—The arch of the aorta is situated in the superior mediastinum, and it is covered in front by the

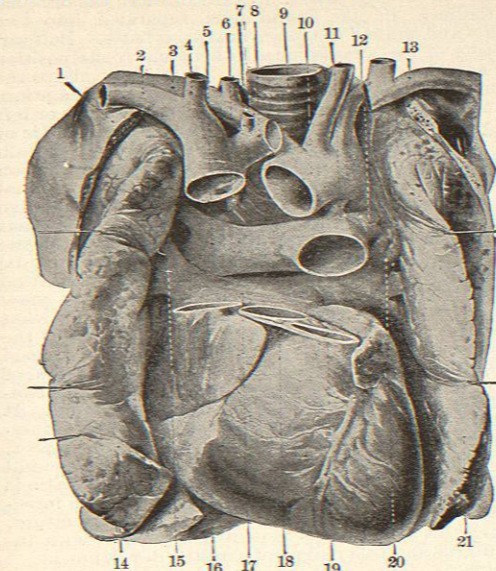


Fig. 240.—Anterior View of the Great Vessels of the Heart. (From His's "Handatlas der Anatomie des Menschen.") 1, First rib; 2, subclavian vein; 3, subclavian artery; 4, internal jugular vein; 5, right branch of pulmonary artery; 6, vena azygos; 7, inferior thyroid vein; 8, left innominate vein; 9, trachea; 10, arch of aorta; 11, ductus arteriosus; 12, left pulmonary artery; 13, subclavian vein; 14, right lung; 15, right pulmonary vein; 16, vena cava superior; 17, left atrium; 18, ascending aorta; 19, pulmonary artery; 20, left pulmonary veins; 21, left lung.

pleura and lungs, and the fatty remnant of the thymus gland. On the left it is crossed by the left pneumogastric and phrenic and the superior cardiac branches of the left

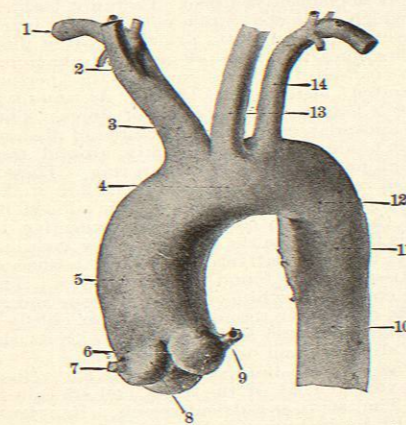


Fig. 241.—Arch of the Aorta with Its Branches (anterior and from the left). After a plaster-of-Paris cast. (From His's "Handatlas der Anatomie des Menschen." Band II., S. 387.) 1, Right subclavian artery; 2, right common carotid; 3, innominate artery; 4, arch of aorta; 5, ascending aorta; 6, bulbus aortæ; 7, right coronary artery; 8, sinuses of the aorta (Valsalva); 9, left coronary artery; 10, thoracic aorta; 11, aortic spindle; 12, aortic isthmus; 13, left common carotid; 14, left subclavian artery.

sympathetic nerve and by the left superior intercostal vein, while the left recurrent laryngeal bends upward beneath it. Posteriorly and to the right lie the trachea, the deep cardiac plexus, the left recurrent laryngeal, the oesophagus, the thoracic duct, and the body of the fourth dorsal vertebra. The anterior part of the upper margin of the arch is in contact with the left innominate vein, and gives origin to the large arteries—innominate, left carotid, and left subclavian—which supply the head and upper limbs. The border is just above the left bronchus and the bifurcation of the pulmonary artery, and it is joined with the left branch of that vessel by a fibrous cord, representing the remains of the ductus arteriosus, which is connected with the aorta just beyond the origin of the left subclavian. Between the arch and the bifurcation of the pulmonary artery are found the superficial cardiac plexus and a few large bronchial lymphatic glands. To its inferior, anterior surface the fibrous pericardium is attached. After giving off its branches, the arch is reduced in size to some extent (23 mm.). There is often seen at that point where the ductus arteriosus is attached, a constricted part, which is called the *aortic isthmus*. The isthmus is far more marked in the fœtus from the expansion caused by the opening of the ductus arteriosus. Beyond comes a fusiform dilatation reaching to the thoracic aorta and called the *aortic spindle* of His.

BRANCHES.—The aortic arch has three branches springing from its upper surface—the innominate or brachiocephalic artery, the left common carotid, and the left subclavian. The left carotid and the innominate arteries are generally nearer together than the left carotid and the left subclavian. These vessels supply the head, neck, upper extremities, and part of the thorax.

VARIETIES.—The upper limit of the aorta may vary as widely as two vertebrae. It is found in some subjects as high as the third dorsal vertebra, at the level of the top of the sternum, while in others it is as low as the fifth dorsal. Sometimes there is complete lateral transposition of the aortic arch and pulmonary artery together with the great veins and the divisions of the heart (*dextrocardia*). This abnormality may be confined to these parts or may embrace all the viscera (*situs inversus*). The aortic arch has been observed to be completely double. It has also been seen to pass to the right of the trachea and oesophagus instead of to the left, and to continue its downward course on the right side of the spine. In this

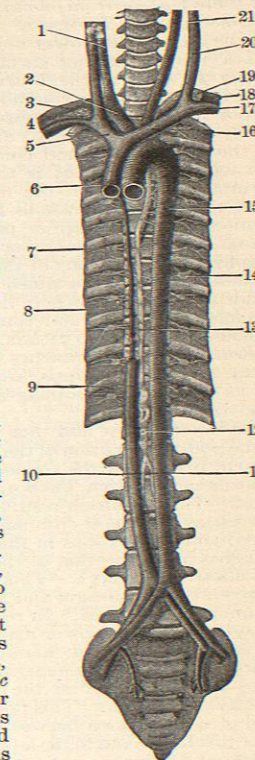


Fig. 242.—View of the Abdominal Aorta. (From Joessel-Waldeyer: "Lehrbuch der Topographisch-Chirurgischen Anatomie.") 1, Right common carotid; 2, innominate artery; 3, right subclavian artery; 4, right lymphatic duct; 5, right innominate artery; 6, superior vena cava; 7, posterior intercostal artery; 8, vena azygos; 9, inferior vena cava; 10, right lumbar lymphatic duct; 11, left lumbar lymphatic duct; 12, receptaculum chyli; 13, thoracic duct; 14, posterior intercostal glands; 15, aorta; 16, left innominate vein; 17, left subclavian vein; 18, left subclavian artery; 19, mouth of thoracic duct; 20, internal jugular vein; 21, left common carotid.

case the three branches have an arrangement the reverse of the usual one.

Variations in the number and position of the branches of the arch are frequent. There may be only one trunk, or there may be from one to six inclusive.

DESCENDING THORACIC AORTA.—At the termination of the arch, at the lower border of the fourth dorsal vertebra, the descending aorta begins and continues down along the spine to the fourth lumbar vertebra, where it divides into the two common iliac arteries. Its direction is not vertical, for as it rests against the spine it necessarily follows the spinal curves, being concave forward in the dorsal region and convex forward in the lumbar. As its commencement is to the left of the spine and its termination nearly in the median line, its general direction throughout its whole length is inward, this being more marked in its upper part. The lower limit of the thoracic aorta is the *hiatus aorticus* at the level of the diaphragm. This part of the aorta is from seven to eight inches long and is contained in the back part of the posterior mediastinum, where it rests against the spine. Its branches are small, and consequently its size is little diminished (from 23 to 21 mm.).

Branches.—The branches of the descending thoracic aorta, though numerous, are small. They are the pericardial, bronchial, cesophageal, posterior mediastinal, and intercostal.

Varieties.—Now and then an obliteration of the aorta at the point of junction of the arch and thoracic aorta is observed, just below the connection between the ductus arteriosus and the arch, known as coarctation of the thoracic aorta. This condition results in the establishment of the interesting collateral circulation which takes place. Not infrequently variations in the number and position of the branches of this section of the aorta are observed.

ABDOMINAL AORTA.—This name is given to the vessel between the diaphragm and its bifurcation into the two common iliac arteries. In relation to the spinal column it begins about the lower margin of the last dorsal vertebra and ends at a point about the middle of the fourth lumbar vertebra, most generally slightly to the left, sometimes almost exactly in the median line, at other times slightly to the right. This point almost corresponds to the level of a line drawn between the two iliac crests or to a point just below and to the left of the umbilicus. In length it is about five inches. As its branches are both numerous and large, its size rapidly diminishes. As mentioned before, its curve as it rests against the vertebrae has its convexity forward, being most prominent at the third lumbar vertebra, slightly above and to the left of the umbilicus.

Relations.—Anterior to the abdominal aorta are the lesser omentum and stomach, the solar plexus, splenic vein, pancreas, left renal vein, transverse duodenum, mesentery, aortic plexus, peritoneum, lymphatic vessels and glands, and dense areolar tissue; posterior to it are the bodies of the vertebrae and the left lumbar veins, the thoracic duct, and the receptaculum chyli. On the right are the inferior vena cava, right crus of the diaphragm, vena azygos major, thoracic duct, and right semilunar ganglion. On the left are the sympathetic nerve and the left semilunar ganglion.

Branches.—These may be classified under two heads: (1) Visceral—coeliac axis (gastric, hepatic, splenic), superior mesenteric, inferior mesenteric, suprarenal, renal, and spermatic or ovarian. (2) Parietal—phrenic, lumbar, and sacra media. The branches of the aorta mostly pass off at right angles.

Varieties.—Instances are known in which the aorta is divided by a septum for either a part or the whole of its course, so that two closely united tubes are the result. Sometimes this condition has a pathological foundation, at other times it is due to an embryological defect in the fusion of the double fetal aorta. The vessel has been known, as in certain quadrupeds, to divide up into an ascending and a descending branch, the former subdividing into three trunks to supply the head and upper extremities. The aorta may vary in position and extent. Its lower limit may vary to the depth of a lumbar vertebra,

so that its bifurcation may take place at the third, or even higher, at the fifth. Its deviation from its normal position with reference to the vertebral column is generally due to pathological changes rather than to congenital causes. Quain speaks of two cases of a large pulmonary branch springing from the aorta very near the coeliac axis, which, after having passed upward through the cesophageal foramen in the diaphragm, separated into two branches and entered the lungs near their bases. Balfour, in writing of the simulation of aneurism by malposition of the aorta due to rickets, says: "In rickety chests the aorta may be so deflected, without any marked dilatation, as to make its pulsation visible either to the right or left of the sternum, and so to simulate an aneurism. It is of even greater consequence to have proof that in certain comparatively rare cases a similar abnormal pulsation may be due to a trifling divergence from the normal course of the vessel itself, apart from any marked change in the bony skeleton. But we must never forget that aortic aneurism may coexist with malformation of the thorax with or without scoliosis, and whatever may be the condition of the skeleton, any abnormal pulsation must be carefully considered from every point of view before we are able to give any definite opinion as to what it really is." Virchow has pointed out the relation of the reduction in size of the aorta to chlorosis, and he named the condition *aorta chlorotica*. Congenital stenosis of the aorta is seldom seen. Rosenbach has noted this condition found together with hypertrophy of the heart. It may cause sudden death, and when it is present, otherwise unimportant affections may assume a grave aspect, from sudden untoward cardiac symptoms. In congenital stenosis of the aortic system, a striking characteristic is the continuous subnormal temperature present in infectious diseases which normally show a high temperature. In women this condition is generally associated with infantile uterus and other signs of arrested development.

STRUCTURE.—The aorta is very strong and elastic and is enclosed, like most other arteries, in a sheath, which has more connective than yellow elastic tissue, so that, when cut, the vessel shrinks within the sheath. It is composed of three coats—(1) tunica intima; (2) tunica media; (3) tunica adventitia. The internal coat, smooth and offering but little, if any, resistance to the blood, consists of three layers: (a) Epithelial layer or arterial endothelium. This is made up chiefly of irregular, flat, polygonal cells with round or oval nuclei with nucleoli. (b) Subepithelial layer, which is well marked and consists of numerous anastomosing cells resting in a delicately fibrillated groundwork of connective tissue. There are, besides, elastic fibres which are in connection with the next layer. (c) Elastic layer, which forms the principal part of this inner coat. Sometimes this network assumes characteristics which have caused it to be designated as the "perforated" or "fenestrated" membrane of Henle. At times it is represented by a longitudinal network of fibres. The middle coat is muscular, consisting of bundles of plain muscle fibres, which are disposed circularly around the vessel, although not forming a complete ring. These fibres contract and relax, thus changing the calibre of the vessel. Elastic fibres are also found well developed in this tunic, and there is also considerable connective tissue. This coat is thicker than the corresponding coat in other arteries. It has also relatively more elastic tissue and less muscular tissue than is found in other arteries. The external coat consists of white connective tissue and elastic fibres. The connective-tissue bundles run chiefly diagonally around the vessel and connect it with its sheath. This is the strongest and densest coat.

Vessels and Nerves.—Both small arteries and veins ramify in the external coat of the aorta and are called *vasa vasorum*. They serve as nutrient vessels. Ranvier states that in health in the human subject they never penetrate to the middle coat. The inner coat is thought to be nourished by the blood circulating through it. Although the aorta is supplied by nerves, it is insensible when in a healthy condition. These nerves are chiefly non-medullated. The finer branches are distributed chiefly to the

muscular tissue of the middle coat. The aorta is supplied by both vaso-constrictor and vaso-dilator fibres. Nerve plexuses are formed around the aorta.

PHYSIOLOGY.—Gibson says that it has been discovered that the effect of an elastic tube on an intermittent flow of fluid is to convert it practically into a continuous stream. The elastic tube, also, by means of its distensibility, allows only part of the fluid to be driven on, and so lessens the propelling force. Hamel, in certain experiments on a frog's muscle, proved that a continuous stream of fluid causes edema, while an intermittent stream does not have this effect. The pressure of the blood is controlled by the general laws of hydrostatics, excepting the influences resulting from cardiac energy, arterial tone, and peripheral resistance. The average blood pressure in the aorta is commonly taken as about 150 mm.

Velocity of the Blood.—In considering the blood in the arteries, two facts must be noted. During systole, the pressure is raised and is sent onward as wave motion. Besides this, there is the propulsion of the blood sent by the heart out into the organism. Arterial pulsation beginning in the aorta is "a wave of increased pressure, travelling from the centre to the periphery of the arterial system." On account of this constant variation of pressure the blood flows continually from the higher to the lower level of pressure. The three factors on which arterial pulsation depends are quantity of blood, cardiac energy, and the resistance offered by the blood-vessels. The force of the heart beat has two results—potential energy stored up in the elastic arterial walls, and kinetic energy, which forces the blood onward. During diastole there is a tendency to negative pressure in the large arteries leaving the heart, causing a "backward wave of pressure and to some extent a backward flow of blood."

PATHOLOGY.—Of all the arteries, the aorta, and particularly its arch, is most subject to pathological changes. First, as to aneurism. McLachlan enumerates many reasons why this affection should be more common in the thoracic aorta than in any other part of the vessel. "(1) It is much curved; (2) it gives off large branches; (3) the first part of the arch has no sheath, and the rest of the thoracic aorta is but feebly supported; (4) the jet of blood driven against its upper wall at each systole is apt to bulge the coats at that point; (5) sudden variations in pressure, according to the state of the heart; (6) the aspiration of the thorax affects it, for as the chest enlarges the vessel tends to expand." When aneurism is found in the sinuses of the ascending aorta, it is most generally seen in the right anterior, since this sinus, from its position, is most exposed to the impulse of the blood currents. When above the sinuses, the aneurism is generally in the anterior wall of the vessel, owing probably to the blood being pumped chiefly against this part. The aneurismal sac generally inclines toward the right and most frequently bursts into the pericardium, causing sudden death. Any of the structures in contact with, and pressed upon by, the aneurism may be affected, and the resulting discomforts are of various kinds. The heart may be displaced or its movements may be impeded. There may be palpitation or abnormal pulsation. Edema occurs from pressure on the veins. Pressure on the cesophagus may cause dysphagia. Pressure on the trachea may produce sensations of choking, shortness of breath, or noisy respiration or brassy cough. Pressure on the different nerves may cause pain, anesthesia, paralysis, alteration of voice, aphonia, hiccup, retching, nausea, inflammation of the lungs. The pupils may be either dilated or contracted. There may be pallor and coldness of the same side of the face and head from vaso-motor stimulation, and later redness and increased heat of the same parts from vaso-motor paralysis. Bone may be eroded, causing agonizing pain. Fatal hemorrhage usually results from the bursting of the aneurism. Death may occur from inanition in consequence of pressure on the thoracic duct. Sometimes the innominate, subclavian, or left carotid may be so blocked by clots as to cause a partial or complete disappearance of the pulse on that side. The thoracic aneurism generally inclines backward along

the left side of the spine, and curvature of the spine may result from its effects on the bone. Osler speaks of a curious phenomenon which he has noticed in two cases of intrathoracic aneurism—the clubbing of the fingers and the incurving of the nails of one hand. In neither case was there any special distention or signs of venous engorgement. Aneurisms of the abdominal aorta are about equally divided between the anterior and posterior walls of the vessel, the most common situation being near the coeliac axis. The symptoms vary accordingly. In lower animals this vessel has been successfully tied, but, although the experiment has been tried on man, recovery has never followed. Sansom, in writing of the diseases of the aorta, speaks of the possibility of abscesses. The vessel walls may be invaded by pyogenic micro-organisms which give rise to abscesses. Aortitis may be acute or chronic. Acute aortitis, according to Gibson, may be of two kinds—(a) an accompaniment of acute disease; (b) primary, *i.e.*, having no apparent connection with acute disease. The former may originate in rheumatism, syphilis, scarlet fever, smallpox, measles, influenza, and tuberculous conditions. It has been associated with pericarditis, pneumonia, and pleurisy. It has followed renal disease, overfatigue, and traumatism, and it has complicated pregnancy and parturition. In short, it is caused by infections and intoxications. Chronic aortitis (atheroma or endarteritis deformans of Virchow) is generally a part of the process of arteriosclerosis, and its etiology is essentially the same, alcohol, syphilis, and overwork being responsible in most cases. Atheroma may be nodular (localized) or diffuse. Tuberculosis of the aorta has been reported. Hyaline degeneration may attack the aorta and, according to Osler, is commonly an initial stage of arteriosclerosis. Lardaceous (amyloid, waxy, or albuminoid) degeneration prepares the way for atrophy and fatty degeneration of these tissues. Fatty degeneration is common. Calcification of the aorta generally occurs in cases in which the nutrition of the vessel wall has been impaired and commonly follows fatty change and atheroma. Ossification of the arterial wall may take place. Wounds of the aorta at the base of the heart or in the descending portion are generally quickly fatal and not within the scope of surgical treatment.

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APHASIA.—Aphasia is a term used to indicate any disturbance or perversion of intellectual expression. It includes all defects or disorders of intellectual expression, whether such disorders be the result of disarrangement or destruction of the receptive or of the emissive components of the speech mechanism, or of anything which may be employed as the substitute or equivalent of speech. Thus a person who, despite the integrity of the peripheral speech mechanism, is unable to utter his own name or to give expression to thoughts arising in the usual way, has aphasia. If he is incapable of communicating thoughts, such as writing of any sort or by expressive mimicry or pantomime, he likewise has aphasia. Moreover, a person has aphasia who, with the extracerebral apparatus intact, is unable to understand the language in the use of which he has been trained; who does not even recognize, although he hears, the sounds of the most familiar nature and words to which he has for a lifetime been accustomed, such as his own name; and who—although he may be able to read—is unable to write voluntarily or from dictation, or to express his thoughts by words, by symbols, or by pantomime.

Yet even these shortcomings do not comprise all that is meant by aphasia. If a person with normal ocular apparatus looks upon a printed or written page, and the symbols there with which he has previously been entirely familiar, convey no meaning to him in the shape of approximate thought or idea, such person has aphasia, even though he may understand all that is communicated orally to him, and though he may himself be able to express his thoughts (incompletely and defectively, however) by spoken and written words.