

its subsequent course are then the same, but during the stage of formation of the sac the conditions present symptoms of dangers peculiar to itself. There is the history of the injury, absence or diminution of pulsation in distal branches, local swelling and ecchymosis, and sometimes marked lowering of the temperature of the limb. There is usually a bruit but no pulsation in the swelling at first, but, after the sac has formed, the expansive pulsation characteristic of an aneurism is present.

During the formative stage of the sac the injury is peculiarly amenable to treatment by direct pressure at the seat of injury; and often after the sac has formed a cure may be effected by the same means. This is the one important practical point of difference between traumatic and spontaneous aneurisms.

When the injury is associated with fracture of a bone the immediate treatment, unless the symptoms are very alarming, should be confined to securing the repair of the fracture and to limiting the extravasation of blood by suitable pressure, and the treatment of the aneurism should be postponed, if possible, until after the bone has united. The presence of the extravasated blood is not a serious obstacle to this repair, while the conversion of the fracture into a compound one by an incision made to secure the wounded artery may have very serious consequences.

Exceptionally, the extravasation may be so free as to endanger the vitality of the limb by its interference with the circulation, and under such circumstances the surgeon may be compelled to turn out the clots and secure the vessel, or even to amputate. This is much more likely to be the case in complete rupture of the artery, when none of the blood brought by the artery is carried past the injury into its distal branches, but all is poured out into the tissues, and, being bound down by the enveloping fascia, exerts a pressure which checks the venous flow and prevents the establishment of collateral circulation. This condition is characterized by great and uniform swelling, absence of pulse, and notable loss of temperature in the limb.

II. ARTERIO-VEIN ANEURISM.—When an abnormal direct communication is established between the trunk of an artery and that of a neighboring vein, the condition is known as an arterio-venous aneurism. When the two vessels remain in close contact, and the blood passes directly from the artery into the vein, the variety is known as *aneurismal varix*, the prominent feature being a varicose dilatation of the vein. When, on the other hand, an aneurismal pouch is formed by condensation of the adjoining tissues, the variety is known as a *varicose aneurism*, or as an arterio-venous aneurism in the narrow sense. In the great majority of cases of varicose aneurism the aneurismal sac is intermediate between the artery and the vein, and blood passes through it on its way



FIG. 200.—Arterio-Venous Aneurism. (Bell.)

from the former to the latter. Broca describes a sub-variety, in which the artery and vein communicate directly with each other and there is an aneurismal pouch lying on the opposite side of the artery. Probably the distinction could not be made during life. In some of the classifications any case that presents a distinct aneurismal tumor, whether enclosed by a sac of new formation or by one formed by circumscribed dilatation of the vein, is called a varicose aneurism; but the latter variety, that in which the aneurism is formed by dilatation of the vein, seems to be much more closely allied in every way to aneurismal varix.

The common cause of this affection is a wound involving both the artery and the vein; but in some cases the communication forms by ulceration of the wall of the

vein where it is pressed upon by an aneurism, and in one case (reported by Pemberton in *Med.-Chirurg. Trans.*, vol. xlv., p. 189) an arterio-venous aneurism formed at the groin ten months after prolonged instrumental pressure had been made at that point to cure a popliteal aneurism. The most frequent cause by far, in the past, has been the wounding of the artery in venesection at the elbow. The cause in recent times is a gunshot or stab wound. Another occasional cause is fracture of the base of the skull, by which the carotid artery is torn in the cavernous sinus. Spontaneous formation by rupture of an aneurism into a vein is rare, and almost confined to thoracic and abdominal aneurisms.

The pathological changes which are found in this class of aneurisms vary greatly in their details, according to the character and extent of the primary injury and of the communication between the vessels, and to the distance of the vessels from the heart. The principal factor in the production of these changes is the extent to which the intra-arterial pressure is transferred to and exerted upon the wall of the vein and the aneurismal sac; and this is determined by the size of the opening in the artery and by the resistance offered to the return of the blood through the vein to the heart. Hence, when the communication is between an artery and a large venous trunk, such as the internal jugular, which can readily carry away the excess of blood almost as rapidly as it is supplied, the distending force is not much exerted and the obstructive changes in the vein are slight; but when the communication is between an artery and a vein in one of the extremities, or in the head, an immense aneurismal pouch may be formed or the veins may become greatly dilated and varicose. The pouch usually has a smooth internal surface and contains little or no stratified clot, and when it is formed in great part by dilatation of the vein, the orifices of other veins opening into it are seen at various points, and these veins are enlarged and their walls thickened.

The artery below the point of communication is smaller than normal, and if it has been entirely divided by the original injury, the lower portion may be occluded at the point of division; the end of the upper portion is kept open by the stream of blood.

The symptoms vary somewhat with the pathological changes; there may be a well-defined pulsating tumor, presenting the usual features of an aneurism and the special ones peculiar to this variety, or there may be simply a diffused swelling of the region, or the superficial adjoining veins may be markedly varicose. The special features are the bruit and the thrill. The bruit is continuous, with a systolic reinforcement; it is most intense immediately over the point of communication between the vessels, and becomes less, or may be changed into an intermittent murmur, as the distance from this point increases. This apparent intermittence is due simply to the fact that the portion of the murmur which corresponds in time to the contraction of the heart is louder than the rest, and is heard at a distance at which the latter has become inaudible. In some cases the murmur could be heard at a great distance along the vessels; thus in one quoted by Follin, it could be heard from the elbow to the heart; in another (of the femoral), from the head to the feet. The *thrill* is a peculiar sensation given to the hand when laid upon the aneurism, a vibration that has been compared to the purring of a cat.

The interference with the circulation below the point of communication is commonly well marked, and is shown by swelling of the limb which is not œdema, but which, in some cases at least, is an actual hypertrophy, and is accompanied by a permanent elevation of the temperature of the limb, by a greater growth of hair upon it, and in one case by an increase of an inch in length. There is a feeling of numbness or of actual pain in the limb, increased by its use, and there may be a marked loss of muscular power, and sometimes persistent ulcers or eczema.

The lesion may fail to become apparent until some time after the receipt of the injury (four years in one

case), and commonly it remains stationary after having reached a certain development. Those situated upon the great vessels, the carotid and internal jugular for example, seldom cause any inconvenience to the patient. In a few cases the opening into the vein has closed spontaneously, and the aneurism has been thus transformed into a simple arterial one.

*Treatment.*—In recent cases carefully graduated, direct pressure has sometimes availed to close the opening, and this may be aided by compression of the artery above. Operative interference in the past, which has included a variety of methods, has proved exceptionally dangerous, but the statistics for obvious reasons have lost much of their value with the improvement in operative methods and in the treatment of wounds. The operations may be divided into two main classes, according as the sac is or is not opened, and in the latter class they will further vary according to the number of the ligatures applied.

The question of interference will be determined by the extent of the disability and the number of vessels involved in the lesion. In the forearm or on the scalp it is usually practicable to tie all the vessels, arterial and venous, that are involved, and thus effect a radical cure. In the neck (carotid and jugular) the history of recorded cases<sup>19</sup> shows that the lesion rarely causes more than a moderate amount of inconvenience, that can be easily borne by the patient.

Ligature of the artery alone on the proximal side, in arterio-venous aneurism of the lower extremity, has proved remarkably fatal by gangrene. In 12 cases collected by Van Buren,<sup>20</sup> the external iliac was tied in 5 and the common femoral in 2, and gangrene followed in all; the femoral was tied in 5, and gangrene occurred in 2. This extraordinary frequency is presumably due to the easy return to the heart, through the opening into the vein, of the blood brought to the distal segment of the artery by the collateral branches; it fails to pass on and nourish the limb. Consequently a second ligature applied to the artery close below the opening, diminishes the chance of gangrene. Ligature of all the veins, as well as of the artery, suppresses all subsequent growth of the sac or continuance of the disease, but it adds a factor that is most important in the production of gangrene—obstruction of the venous flow. Moreover, the operative difficulties are extreme. The record of cases in which the sac has been opened and the attempt made to arrest all bleeding from it, is such as to discourage any one from undertaking it; again and again operators have had to resort to ligatures *en masse*, passed by means of curved needles, and more or less blindly, in deep, inaccessible corners of the wound, to the actual cautery, and even to styptics and pressure. The incision has always been very long, and the tissues have been bruised and lacerated by the prolonged search and dissection. In the only case I have witnessed, an aneurism of the upper part of the calf, the incision was more than a foot in length, the operation lasted about two hours, and, at the last, resort was had to persulphate of iron and graduated compresses packed deep in the wound. The wound could not be kept aseptic, and the patient died on the third day of acute septicæmia. The method seems to violate all the principles that govern modern methods of making and treating wounds, and it does so, in my opinion, in the effort to attain an end that is not only unnecessary, but introduces an element of great additional danger. If the double ligature of the artery alone is too dangerous to be employed, the more extensive operations are still more so. Whether or not the double ligature is too dangerous, under the modern improvements, is yet to be determined, but I am convinced that it is the only one which the surgeon should employ. In 1882, Professor Verneuil<sup>21</sup> treated an arterio-venous aneurism of the popliteal space by ligature of the artery and vein on the proximal side. After the ligature had been applied and the tourniquet removed, the tumor filled slowly with blood, and the surgeon then opened the sac and sought to secure all the vessels that opened into it. The patient recovered, but in the remarks which the distinguished

surgeon made upon the case (*loc. cit.*, p. 276), he expressed his regret that he had opened the sac. He does not explain why he tied the vein as well as the artery; doubtless he had a good reason for it, but, in ignorance of that reason, it seems to me a mistake to oppose the escape of blood from the sac toward the heart. Probably he sought to effect a cure, as in other aneurisms, by inducing coagulation and obliteration, and deemed it inadvisable to allow the venous stream to pass through the dilated and varicose veins. The case is quoted to show what others have also shown, that a cure is possible, without gangrene, even under operative conditions that favor the occurrence of that complication, and that a like favorable result may be expected in a proportion yet to be determined, from the less difficult and dangerous operation of double ligature of the artery.

A few successes have been obtained by galvano-puncture and by the injection of coagulating solutions without ligaturing any vessel, and quite recently, in a few cases in which the changes were not very extensive, the sac has been successfully extirpated.

III. CIRROID ANEURISM (arterial varix; aneurism by anastomosis).—This name has been given to an affection of the arteries, sometimes involving also the capillaries and even the derived veins, which differs materially from that which constitutes the common variety of aneurism, and is characterized by a uniform or irregular dilatation and tortuous lengthening of an artery and its branches. The affection is most common in the superficial arteries of the head—the temporal, occipital, and auricular—but it is also found in the hand, forearm, leg, and even involving the external iliac artery.

The change consists in a dilatation and lengthening of the artery, with atrophy of its middle coat and consequent thinning of the wall, or possibly with hypertrophy by thickening of the middle coat in the early stages; the dilatation may make the calibre of the vessel ten times larger than normal, and may be uniform, but is usually accompanied by the formation of small pouches. In consequence of the lengthening the artery assumes a tortuous form. The change has a marked tendency to spread in both directions, involving the arterial branches and even the consecutive capillaries and veins, and in the latter case it is known as *aneurism by anastomosis* or *racemose aneurism*. There is also reason to think that in some cases the change has originated in a *nævus* and has spread backward to the arteries. At the central portion of the tumor, where the tortuous and dilated vessels are most numerous and closely packed, there may exist, as Lefort<sup>22</sup> has pointed out, a sort of central lake, as in cavernous angioma, or a real aneurism, or even an arterio-venous aneurism. The overlying skin and soft parts may be thinned, or thickened and indurated, and the underlying bone may be absorbed in consequence of the pressure.

The principal causes are found in contusions and pre-existing erectile tumors or birth-marks, and the change takes place most frequently at the time, or shortly after, the age of puberty is reached. In what manner or through what agency these causes act is not known, nor why the region of the head is the common seat.

The symptoms of the disease are a soft, ill-defined swelling under the skin, in which numerous pulsating vessels can be felt, and into which tortuous arteries can be seen to pass. The overlying skin is reddened or livid, either by implication of its own minute vessels or by transmission of the color of the blood below it; the tumor communicates a sort of thrill to the hand, and a continuous murmur to the ear. In a complete typical case four distinct varieties of changes or lesions can be recognized: First, a cutaneous erectile tumor, formed by dilatation of the arterial capillaries of the skin; second, a subcutaneous arterial cirroid tumor, formed by the dilatation of the finest arterioles under and around the first; third, dilatation and tortuosity of the main arteries leading to the tumor; fourth, dilatation of the veins coming from the tumor, sometimes with pulsations synchronous with those of the heart.



The affection is a serious one, because of its tendency to increase and the danger of hemorrhage through ulceration of the skin or an accidental injury.

Treatment has generally proved not only difficult, bloody, and dangerous, but also unsatisfactory as regards the cure of the disease. It comprises ligation of the main trunks from which the affected arteries arise, as of the temporal, or the external or common carotid, in circoid aneurism of the scalp; excision or incision of the tumor; caustics; galvano-puncture; and coagulating injections. Lefort (*loc. cit.*), who made a careful study of eighty-three cases, says that whenever treatment has been directed only to the afferent arteries, it has failed or has produced only an incomplete cure; but that, on the other hand, the obliteration of the vessels forming the central portion of the mass has been followed by the return of the afferent vessels to their normal condition. He claims, therefore, that the treatment should always be directed to this central portion. It includes three methods: removal or destruction of the mass by caustics or the knife; the injection of coagulating liquids; galvano-puncture. Removal by the knife exposes to severe hemorrhage, but, if practised with caution, is practicable and to be recommended when the central mass predominates. Destruction by caustics (chloride of zinc) seems to be without much danger of hemorrhage, but is slow and tedious and may cause superficial necrosis of underlying bone. Lefort recommends the injection of a solution of the perchloride of iron, which has given nine successes in ten cases; he prefers a five-per-cent. solution to the stronger ones. Dr. John Duncan<sup>19</sup> refers to four cases treated by electrolysis, three of them successfully. The variety known as aneurism by anastomosis, in which the capillaries and veins are also involved, is less amenable than the others to this method of treatment.

IV. DISSECTING ANEURISM.—This is a lesion occasionally found in the aorta, which has only a pathological interest, since it cannot be recognized with certainty during life and is not open to treatment. It consists of a partial rupture of the wall of the vessel, and the passage of the blood between its coats, usually in the substance of the middle coat, to a second opening into the lumen of the vessel at a lower point, or backward to one into the pericardial sac. The primary opening is usually in the arch of the aorta; the second one may be in the same vessel, or at a considerable distance in one of its branches—once in the subclavian, once even in the popliteal. When the flow is backward into the pericardium, death promptly follows; in other cases the period of survival is usually short, but may be prolonged for years, and under such circumstances the track followed by the blood develops a resisting wall lined with epithelium.

Levitt A. Stimson.

<sup>1</sup> E. Home, in Trans. of Soc. for Improvement of Med. and Surg. Knowledge, p. 144, London, 1873.  
<sup>2</sup> The Successful Treatment of Aneurism by Consolidation of the Contents of the Sac. By Jolliffe Tufnell, F.R.C.S.I., etc., second edition, London, 1875.  
<sup>3</sup> Practitioner, London, 1879, vol. xxiii., p. 31.  
<sup>4</sup> Van Buren: The Treatment of Aneurism. Transactions of International Medical Congress, Philadelphia, 1876.  
<sup>5</sup> Lancet, December 19, 1874.  
<sup>6</sup> Amer. Journ. Med. Sci., January, 1881.  
<sup>7</sup> Med.-Chir. Trans., vol. xlv., p. 189.  
<sup>8</sup> Holmes: Lancet, November 16, 1872.  
<sup>9</sup> British Med. Journal, October 30, 1875.  
<sup>10</sup> Holmes: Lancet, November 16, 1872.  
<sup>11</sup> Dublin Med. Press, November 24, 1875.  
<sup>12</sup> Med.-Chir. Trans., vol. lviii., 1875, p. 337.  
<sup>13</sup> Amer. Journ. Med. Sci., April, 1881.  
<sup>14</sup> Amer. Journ. Med. Sci., January, 1870.  
<sup>15</sup> Stimson, in Amer. Journ. Med. Sci., July, 1880.  
<sup>16</sup> Medical Times and Gazette, May 23, 1857.  
<sup>17</sup> Amer. Journ. Med. Sci., April, 1877.  
<sup>18</sup> Duncan, in British Med. Journal, August, 1875, and June, 1876.  
<sup>19</sup> Stimson, in Amer. Journ. Med. Sci., April, 1884.  
<sup>20</sup> New York Journal of Medicine, 1848, vol. ii., p. 168.  
<sup>21</sup> Bull. de la soc. de chirurgie, p. 280, Paris, 1883.  
<sup>22</sup> Dict. encyclopédique des sc. méd., art. Cirsoïdes.  
<sup>23</sup> British Medical Journal, 1876, i., p. 715.

ANEURISM, ABDOMINAL.—ETIOLOGY.—The principal predisposing causes of abdominal aortic aneurism are endarteritis and atheroma, which mainly originate in

chronic alcoholism, rheumatism, or syphilis, and which act by impairing the strength and elasticity of the arterial walls. Atheroma is rather less frequently a precursor of abdominal than of thoracic aneurism.

The exciting causes consist in falls, blows upon the back or abdomen, sudden movements, and violent or prolonged muscular efforts. The disease accordingly exhibits a marked preference for middle-aged members of the laboring classes, and for the male sex, which furnishes about ninety per cent. of all the cases. The causative influence of excessive muscular exertion and of rapid changes in position depends upon the sudden increase of arterial tension resulting from augmented cardiac action, as well as upon the alternating elongation and relaxation of the aorta incident to movements of flexion and extension in the freely mobile lumbar portion of the spine. Blows and falls act as exciting causes in the same manner or by direct injury to the delicate internal and middle arterial tunics.

MORBID ANATOMY.—Aneurisms of the abdominal aorta are, according to the statistics of Crisp, who analyzed 591 cases, only one-third so frequent as thoracic aortic aneurisms. They are usually located in the vicinity of the celiac axis, often involving its orifice, but may affect any portion of the main trunk or any of its ramifications. Dr. Sibson, who tabulated 177 cases, found 131 aneurisms situated at or very near the celiac axis. Quincke asserts that the site is more frequently *below* than above the axis. The branches most often involved are the common iliac arteries, the celiac axis and its three divisions, the superior and inferior mesenterics, and the renal artery. Rather less than fifty per cent. of the aneurisms arise from the anterior aspect of the aorta. They are sacculated, according to Sibson, in sixty per cent. of the cases, and belong, ordinarily, to the false-sacculated, dissecting, or diffuse varieties. They often attain large dimensions, and exert injurious pressure upon adjacent viscera, notably upon the spine, the spinal cord and nerves, the solar plexus, the pancreas, the large and small intestine, the stomach, the kidney and its vessels, the vena cava, the psoas muscles, the receptaculum chyli, the thoracic duct, the branches of the aorta, and the aorta itself. This pressure frequently induces absorption of the neighboring soft tissues, with erosion of the vertebrae, of the intervertebral fibro-cartilages, and of the ribs, intimate adhesions having first been formed between these structures and the aneurism.

The arterial sac undergoes atrophy and absorption, occasioned by augmented intra-arterial and external pressure, and finally ruptures, after a period varying from a few days to several years. The blood escapes into the peritoneal cavity, the retroperitoneal connective tissue, the intestine, the pelvis of the kidney or the urethra, the ductus communis choledochus, the sheath of the psoas magnus, the vena cava inferior, the mesentery, the mesocolon, the gastro-hepatic omentum, or the spinal canal. Even the diaphragm may be perforated, rupture then occurring into the left pleura, lung, primary bronchus, or into the pericardium. The method of perforation presents interesting differences, according as rupture takes place into the peritoneal and pleural cavities, or upon a cutaneous or mucous surface. In the former case, the rupture is effected by a sudden tearing of the distended and atrophied serous structure, while, in the latter, gangrene of the cutis or of the mucous membrane is produced by protracted tension and compression. In the former case the hemorrhage is, almost unavoidably, sudden and profuse. In the latter, the aperture may be of small dimensions and partly occluded by thrombi. The fatal issue may thus be postponed, even for weeks, by the gradual formation of a diffuse aneurism from a slow escape of blood into the submucous or subcutaneous cellular tissue. Such diffuse aneurisms may even extend so far as beneath the iliac and pelvic fascia, or may penetrate between the layers of the mesentery and of the omenta.

Spontaneous cures are infrequently effected by processes described in the preceding article.

PHYSICAL SIGNS.—Small aneurisms, growing from the posterior aspect of the aorta and enlarging exclusively backward, may defy detection by any method of physical exploration. So soon, however, as an aneurism growing from the anterior aortic wall has attained a moderate size, it usually presents on inspection, provided that the abdominal parietes be sufficiently relaxed and the intestines undistended, a visible impulse in the course of the abdominal aorta. If the aneurism be of large dimensions, the abdominal respiratory movements may be decreased, and those of the thorax perceptibly augmented. Jaccoud emphasizes the fact that the tumor, being immobile, is unaffected by the respiratory movements. On palpation an immobile, elastic tumor, pulsating, according to Sibson, in fifty-five per cent. of the cases, the impulse of which is systolic and expansile, is commonly detected in the epigastrium, to the left of the median line, but may project to the right side, or even be found in the hypochondriac, the iliac, or the lumbar region. A slight diastolic impulse may rarely be observed. The tumor is ordinarily smooth and compressible, but sometimes nodular, unyielding, and even non-expansile. In the latter case it may be assumed that the aneurismal walls are very thick, that abundant coagula and fibrous laminae are present within the sac, or that the aperture communicating with the artery is occluded. The pulsations in the arteries of the lower extremities are feeble and somewhat retarded. Pressure applied to the artery *above* the tumor diminishes the size of the latter and arrests the impulse, but if made *below*, augments the tumor's dimensions and increases its impulse. Applied directly to the tumor, pressure may occasion its collapse, or may be prevented from producing this result by too great solidity and density of the fibrous laminae within the sac. A thrill or vibratory fremitus is occasionally perceptible over the tumor, but is oftener absent. On auscultation a murmur, blowing or musical, post-systolic, always single, according to Luton and Walshe, and not transmitted beyond the tumor, is usually perceptible anteriorly, rarely posteriorly, if the recumbent position be maintained. Quincke states that the murmur may sometimes be heard below the tumor, or in the lumbar region. The murmur is occasioned by the passage of blood into the sac. If the aperture of the latter be rough, the sound is rasping or musical, but it is soft and blowing if the opening be smooth. Over aneurisms enlarging only in a backward direction the murmur is perceived exclusively behind, beside the vertebral spines. In other cases it may be audible both anteriorly and posteriorly. Should the patient assume the erect posture, the murmur almost invariably disappears; but it may, exceptionally, persist in that position, or even be *only* audible while the patient is standing or sitting. The disappearance of the murmur in the erect posture is explained by the augmented tension of the aneurismal walls, occasioned by increased hydrostatic pressure, and by the consequent limitation of the quantity of blood finding ingress to the sac. No safe inference can be drawn, from the intensity or the quality of the murmur, regarding the size or the stage of development reached by the aneurism. Many observers agree that the second cardiac sound is sometimes heard, either in front or behind, after the usual post-systolic murmur.

On percussion flatness or dullness may be found over the tumor, but these signs are inconstant, owing to the frequent occurrence of gastric and intestinal tympanites, and to the varying rigidity of the abdominal parietes.

RATIONAL SYMPTOMS.—These are either local and due to pressure, or general and dependent upon asthenia. The most constant localized symptom is pain, which is very variable in character, in position, and in intensity. It presents itself in two different varieties, the former constant, the latter paroxysmal. The former variety is variously defined as dull, boring, throbbing, or teasing; the latter as sharp, lancinating, and exhausting. The sites of the former are the epigastrium, the dorsal and the lumbar regions; while the latter, originating in these locations, radiates into the hypochondria, the inguinal

regions, the hips, the testicles, down the anterior or posterior aspect of the thighs, and even upward into the thorax or the shoulders. The pains are the result of pressure exerted by the aneurism upon the spinal nerves, at their exit from the intervertebral foramina, and upon the solar plexus. There is no constant and necessary connection between erosion of the vertebrae and the occurrence of pain, since many cases are on record of pain from pressure on the nerves unattended by erosion, and, on the other hand, of extensive erosion without the slightest pain. Erosion is, however, of tolerably constant occurrence. Pains due to pressure on the nerves will naturally be produced, as a rule, by aneurisms growing from the posterior aspect of the aorta, and those referable to interference with the semilunar ganglia by tumors developing from the anterior aortic wall. The intensity of the pain varies from a vague and scarcely perceptible sense of discomfort to the most excruciating torture. The lancinating pains usually surpass the fixed ones in point of severity, and both varieties are intensified as the disease advances. The fixed pain is constant, and is greatly aggravated by pressure over the painful spot, by sudden exertions, or even by trifling movements, by eating and drinking, and by the assumption of the supine or of the erect position. Relief is afforded by the assumption of the abdominal decubitus, by flexion of the spinal column, and rarely by pressure. The duration of the paroxysmal neuralgic pains varies from a few moments to several hours. Their accession is abrupt and their subsidence equally so. After their cessation the patient is left in a comparatively painless, but exceedingly asthenic condition. In a few recorded cases pain has been absolutely wanting.

The symptoms other than pain, resulting from pressure, are occasioned by direct interference with the functions of organs adjacent to the aneurismal tumors. Nausea, emesis, cardialgia, pyrosis, dysphagia, anorexia, tympanites, eructations, gastralgia and enteralgia, constipation, obstipation, and diarrhoea may be incident to pressure upon the stomach, cesophagus, intestine, or pancreas, and are probably in part due to interference with the sympathetic and pneumogastric nerves.

Digestive disturbances are less pronounced in connection with aneurisms growing from the posterior aortic wall. Pressure upon the liver, the hepatic duct, or the ductus communis choledochus may lead to icterus. Dyspnoea is incident to upward displacement of the diaphragm and to consequent encroachment upon the intra-thoracic space. Irregular cardiac action attends displacement of the heart or involvement of the pericardium. Cough may be excited by irritation and inflammation of the pleura and of the pulmonary parenchyma. Compression of the renal vessels produces functional or structural disease of the kidneys. Edema of the lower extremities is a rare symptom, due to pressure upon the vena cava inferior, which vessel, from its position, often escapes injury. Ascites results from pressure upon, or obliteration of, the portal vein, but is an exceedingly infrequent symptom. A subnormal temperature of the lower limbs, with hyperaesthesia, formication, numbness, anaesthesia, and final paralysis, are the occasional effects of pressure upon the spinal cord and nerves. Renal and biliary colic may proceed from pressure upon the ureter and the biliary passage. Irritation of the psoas magnus excites symptoms similar to those of psoas or lumbar abscess.

THE GENERAL SYMPTOMS consist in gradual depreciation of the vital powers by reason of the pain, insomnia, malnutrition, and impaired innervation. Extreme emaciation is sometimes observed, and may, in the absence of other adequate causes, be referred to compression or obliteration of the receptaculum chyli or of the thoracic duct. Death from exhaustion occasionally happens, but the usual termination is by rupture and hemorrhage. The symptoms of rupture are either those of sudden collapse or, if the hemorrhage be of gradual occurrence, those of intra-abdominal or intra-thoracic diffused aneurism and of progressive asthenia, possibly complicated by peritoni-



tis or attended by recurrent hæmoptysis, hæmatemesis, hæmaturia, or melaena.

**ANEURISMS OF BRANCHES OF THE ABDOMINAL AORTA.**—Owing to their rarity and to their comparatively small size, aneurisms of the abdominal branches of the aorta usually present so few symptoms as to escape observation or to elude diagnosis. The branches most frequently the seat of aneurisms are, according to Lebert, the iliacs, the cœliac axis and its divisions, the superior mesenterics, and the renals, in the order named. The symptoms and signs of these tumors are similar to those of aortic aneurisms. Aneurisms of the superior mesenterics and of the cœliac axis are, however, *mobile*, and usually occasion no retardation or diminution in the pulsation of the femoral arteries. Renal aneurism is specially liable to interfere, by pressure on the ureter and the renal vein, with the functions of the kidney, and hepatic aneurisms often lead to jaundice. Statistical data regarding the relative frequency of ascites, in cases of hepatic aneurisms, are lacking.

**DIFFERENTIAL DIAGNOSIS.**—Abdominal aneurisms must be differentiated, first, from abdominal tumors to which the aortic pulsation is communicated. Those tumors most likely to be mistaken for aneurisms are carcinoma of the stomach, pancreas, omentum, intestine, and liver, fecal tumors, gall stones or foreign bodies impacted in the intestine, enlarged lumbar and mesenteric glands, renal tumors, as hydro- or pyonephrosis, floating kidney, ovarian or uterine tumors, enlarged or displaced left lobe of the liver, and encysted peritoneal exudations. Not only may these tumors receive an impulse from the aorta but they may produce a murmur by pressure upon that vessel. The character of their impulse is, however, heaving or lifting and not expansile, and it, as well as the murmur, can ordinarily be made to disappear by placing the patient upon his hands and knees, when the tumor gravitates away from the artery. The tumors in question are, as a rule, movable, while aneurisms of the aorta are immovable. Aneurisms of the aorta's branches may be mobile, but their murmur persists after displacement of the aneurisms from their original position, which is not true of the other tumors under consideration. The latter are, moreover, of firmer consistency, and are more frequently accompanied by varicose abdominal veins, by ascites, or by œdema of the legs, and, if carcinomatous or tuberculous, by a more decided cachexia.

Secondly, from lumbar and psoas abscesses, which simulate aneurisms chiefly by causing dorsal pain and spinal curvature, but which are unattended by impulse, thrill, or murmur.

Thirdly, from various neuralgic affections, as renal and biliary calculus, gastralgia, enteralgia, neuralgia of the testicle, lead colic, lumbago, muscular rheumatism, and sciatica, the exclusion of which must depend on thorough physical exploration.

Fourthly, from abnormally forcible pulsation of the aorta. This is not accompanied by pain, thrill, dulness, murmur (unless the latter be excited by pressure with the stethoscope), or expansile impulse, and is often developed in connection with dyspepsia, profuse hemorrhage, or hysteria in young, chlorotic women. This form of pulsation is not localized but propagated through the entire aorta and its chief branches, nor is it attended by abnormal dilatation of the artery. It may be produced either by temporarily increased force of the systole, due to excitement, or by hypertrophy of the left ventricle. It is sometimes observed in aged women, with relaxed or retracted abdominal walls, and with lessened arterial pressure incident to spanemia.

Fifthly, from pulsatile, malignant, renal, hepatic, or pancreatic tumors which, though very difficult to diagnose, are accompanied by more marked cachexia than is generally present in cases of aneurism.

Sixthly, from abscesses or furuncles of the abdominal walls, the superficial and inflammatory character of which is easily demonstrated.

**PROGNOSIS.**—Abdominal aneurism is an exceedingly

grave disease. While cures, either spontaneous or due to therapeutical interference, are sometimes observed, the overwhelming majority of cases terminate fatally within a period varying from a few months to several years, either by rupture, which occurs, according to Sibson, in seventy-seven per cent. of all the cases, or by progressive exhaustion. The prognosis is unfavorably affected by the coexistence of any chronic disease, particularly of emphysema, phthisis, or asthma, which accelerate the progress of the aneurism by the repeated succussion movements incident to paroxysms of coughing. In some instances, all symptoms may disappear, only to reappear after a variable interval. In other cases the disease may remain latent until shortly before its fatal termination.

**TREATMENT.**—This is either palliative or curative. The former aims at the mitigation of suffering caused by pressure or by complicating diseases, the latter at obliteration of the aneurismal sac by the deposition of laminated fibrin. The means best adapted to the palliation of pain are chloroform and aconite, hot applications, leeching and cupping, employed at the seat of the aneurism, and, most potent of all, morphine hypodermically administered. Insomnia demands chloral and opiates.

The means employed to facilitate and hasten the deposition of fibrin within the sac relate to reduction of arterial tension, and to diminution of the rapidity of the blood current. Valsalva's method, based upon venesection and starvation, has justly been abandoned. The postural and dietetic treatment of Mr. Tufnell has yielded encouraging results. As an example of these we cite two abdominal aneurisms cured by Mr. Tufnell, after treatment protracted respectively thirty-seven and twenty-one days. In accordance with this method the patient is confined to the horizontal posture from eight to thirteen weeks, according to the progress made. No movement is allowed, and the diet is restricted to eight ounces of liquid and ten ounces of solids daily, the *ménu* being as follows: For breakfast and supper, two ounces of wheaten bread and butter, with two ounces of milk, tea, or cocoa; for dinner, meat three ounces, potatoes or bread three ounces, and water or claret four ounces. Laxatives are daily used. The probably insurmountable difficulty attending this method consists in the physician's inability to secure the patient's efficient co-operation in so protracted and fatiguing a treatment. Better co-operation and greater success may be expected if the treatment merely embrace the limitation of physical exertion within proper bounds, the employment of nourishing but unstimulating aliments and drinks, attention to the bowels, and the use of aconite, or of hydrocyanic acid, to secure regular and moderate cardiac action. Alcoholics may, however, be sparingly used in case of evident cardiac weakness. Iodide of potassium, in doses of fifteen to twenty grains, thrice daily, is strongly recommended by Doctors Balfour, A. Flint, and Bouillaud. Its beneficial effect is attributable to depression of the heart's action and to consequent diminution of vascular tension. Ergot, hypodermically, is advocated by von Langenbeck on the same theoretical grounds.

Proximal or distal compression of the abdominal aorta for the cure of abdominal aneurism, first suggested by Mr. Holmes, finds many warm advocates and boasts a number of successful results. The preliminary treatment consists in evacuation of the bowel and in the expulsion of flatus. Anæsthesia is essential. The instrument employed is the abdominal tourniquet, and sufficient pressure is applied completely to arrest the blood current in the aneurism. Mr. Murray recommends that the treatment be conducted as follows:

1. That pressure be applied for four hours. If no effect be then apparent, the first attempt is abandoned. If any diminution of impulse be manifest, the tourniquet is applied for another hour.

2. In the event of failure, at the first operation, another trial is made, after a few days, and pressure maintained for from six to eight hours.

3. If the second attempt fail, pressure may be con-

tinued, at the third operation, twelve hours, but it must be instantly removed if inflammation or shock supervene.

William H. Flint.

**ANEURISM, THORACIC.\***—In this article no attempt is made to discuss in detail the pathology of aneurism in general, as that will be found under its proper heading. It is intended rather to present in as condensed a form as possible the principal points bearing upon the diagnosis and treatment of this particular form of the disease.

**ETIOLOGY AND PATHOLOGY.**—In seeking for the causes which are operative in the production of thoracic, as of other forms of aneurism, we must bear in mind the two main conditions which are in themselves the most powerful agents, viz., a weakened condition of the arterial walls, and increased blood pressure. All circumstances, therefore, which tend to bring about one or other of these disordered states tend to induce the formation of an aneurism. Probably one alone will sometimes be sufficient, but if both together unite, the necessary consequences are rendered still more certain.

The constitutional conditions which are known to predispose to atheroma and, therefore, to aneurism are hereditary predisposition, gout, rheumatism, kidney disease, syphilis, and alcoholism. To these must also be added strain and laborious occupations involving repeated (though less severe) straining efforts. It is sudden increase in the blood pressure, however, which is much more liable to induce aneurism than prolonged exposure to a moderate degree of increased tension, as seen in Bright's disease. It has, moreover, been fully proven that tight clothing, as in soldiers, acts injuriously in intensifying the effect of any straining effort. Occupation, therefore, is a direct exciting cause of thoracic aneurism. Any kind of work which, besides being laborious, involves at times powerful muscular efforts, must be looked upon as a factor—perhaps often the most important factor—in the etiology. Soldiers, as above noted, are notoriously prone to be affected by it, being subject to a combination of injurious influences. Prostitutes, also, frequently have aneurism of the chest from being affected with syphilis and leading lives of dissipation and excitement, highly provocative of muscular disturbances. According to Hare's statistical results a history of trauma is frequent in cases of aneurism. It is well established that one or more of the coats of a healthy artery may be ruptured by sudden strain or direct violence, whilst in vessels weakened by sclerotic changes, syphilitic or otherwise, such an accident is more apt to occur. An interesting case of this character is quoted by Gairdner in Allbutt's "System," together with a full discussion of the whole subject.

**AGE.**—Aneurism of the aorta may occur at any age, but it is especially common at the more advanced periods of middle life—between forty and fifty—but it is not infrequent between thirty and forty. Very few cases have been observed below twenty. The disease, although rare, is not unknown in children, in whom a syphilitic origin is almost invariable. The arteries of young persons are sound and will bear a sudden strain without injury. Old people very commonly have atheromatous arteries, but in them the circulation is weaker, strain is rare, and thus they seldom suffer from aneurism.

**SEX.**—Men are much more liable to aneurism than women. According to Dr. Peacock, from two-thirds to four-fifths of the cases of circumscribed aneurism occur in males, while dissecting aneurism makes its appearance in the two sexes with equal frequency. The difference is, no doubt, to be accounted for from the fact that men are much more exposed to the efficient promoting causes, viz., strain, laborious occupations, syphilis, and intemperance.

**SYMPTOMATOLOGY.**—The mere existence of a dilatation at some part of the aorta is not necessarily accompanied by manifestations of disordered function or local distress

\* As a friend and pupil of the late Dr. Ross I have been requested to revise this article.—F. G. Finley.

(symptoms). Unless, therefore, it mechanically interferes with neighboring parts, it may continue even for a long time unsuspected. The occurrence, then, of symptoms which will indicate the existence of thoracic aneurism, depends more upon the exact situation of the tumor than upon any other circumstance. The symptoms also will present wonderful variety in accordance with the varying locality and direction of the expansion of the growth. The clinical history of these patients previous to the development of the characteristic symptoms is often extremely indefinite. It is quite common to find a man seeking advice for a loss of voice or a harsh cough, or a thoracic pain, found to be due to an aneurism of some standing, and yet he will give an account of having enjoyed excellent health in every respect until (perhaps quite recently) these symptoms attracted his attention. Again, sometimes a quick pain, with palpitation and breathlessness, has been observed at some remote period, to be followed later on by other symptoms of intra-thoracic disorder. Or, some laryngeal or bronchial symptoms may have been coming on imperceptibly for a long time past. In many cases, belonging to one of the above types, of men above middle age, whose general health and nutrition remain unimpaired, suspicion of aneurism may very reasonably be entertained. Deep-seated aneurisms may be entirely latent, presenting no evidence of their existence by either symptoms or physical signs. The comparative frequency of such cases is now being very generally recognized.

The symptoms of thoracic aneurism, therefore, are mainly the symptoms of intra-thoracic pressure, and mostly differ in no respect from those produced by tumors of different nature in the same situation. The symptoms consist of the manifestations by which we can recognize displacement of lung substance, compression of the main or secondary air tubes, irritation or destruction of nerves, obliteration of venous channels, obstruction of the œsophageal tube, or erosion of some of the bony structures.

The principal symptoms of intra-thoracic pressure may be thus enumerated—pain, dyspnoea, altered voice, cough, stridor, headache, and disordered vision, and lastly, paraplegia.

The *pain* of thoracic aneurism is a most frequent symptom, but very variable as to its character, degree, and situation. In not a few cases pain of some kind will be the first indication of existing disorder. Early pain is usually of a somewhat lancinating nature, and is suggestive of neuralgia. It is often complained of as darting across some region of the chest or along certain nerves to distant parts. When the aneurism, for example, is seated in or near the innominate artery, the pain is often referred to the back of the neck on the right side and behind the right ear; when it is seated in the transverse arch, the pain may be across the top of the chest and down perhaps the entire length of one arm. Pains of this kind should always prompt a search for internal aneurism. Later on in the complaint the pain is likely to be of a steady, wearing kind, and referred to some fixed spot, probably deep in the chest. Aneurisms pressing backward against the vertebral column and the spinal nerves emerging therefrom have two special forms of pain connected with them: either a persistent boring pain experienced in some particular part of the spinal column, or a definite intercostal neuralgia, having a distributive, intermittent character, and tender spots often unusually well marked. There is sometimes pain of a real anginoid character, accompanied by a sense of tightness in the chest, but it is very seldom that attacks of true angina, with the typical features of this complaint, are witnessed. Pressure on the phrenic nerve has been found sometimes to be accompanied by a painful feeling of constriction round the lower part of the thorax, together with dyspnoea and singultus, from disturbed innervation of the diaphragm.

*Dyspnoea* is a very frequent symptom, and is of varying character and degree in accordance with the cause to which it may be due. It may arise from compression of