

is very variable. The beating may subside in a few minutes, or several hours may be occupied in returning to the normal. At the conclusion of the paroxysm, a quantity of pale, limpid urine is usually passed, and there is a strong sense of fatigue and exhaustion, with a tendency to sleep.

**Treatment.**—Prophylaxis is important. The vice, of whatever kind, on which the attacks depend, should be removed. Tea, coffee, and spirit drinking must be given up; errors of digestion, reflex disturbances, and curable diseases must be corrected or cured. The hygiene of the individual must be carefully investigated, and sources of disturbance be put aside. The general health must be maintained at the highest point of efficiency. In the absence of any explanation of the paroxysms, the presence of a tape-worm may be suspected. For the immediate relief of the paroxysm, there is no remedy so efficient as the hypodermatic injection of morphia. If the surface is pale and the extreme vessels contracted, inhalation of nitrite of amyl (two or three drops) affords prompt relief. The inhalation of ether is also effective. All narcotic agents must be used with caution, because of the certainty, if the attacks are frequent, that the habit of their abuse will be formed. The application of cold, in the form of an ice-bag to the præcordial space, is an effective means of quieting the heart. The galvanic current, from ten to thirty or forty elements, passed through the pneumogastric and cervical ganglia of the sympathetic, often gives great relief. If there is no cardiac disease, chloral is an efficient quieting agent, and the bromides may also be given with good results.

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## DISEASES OF THE BLOOD-VESSELS.

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### ARTERITIS—INFLAMMATION OF THE ARTERIES.

**Definition.**—The acute form of arteritis is uncommon, and is rather a surgical than a medical topic. Chronic arteritis, on the other hand, is not only a common but it is an extremely important disease. It has received various designations, as *endarteritis*, *atheromatous arteritis*, *arterial sclerosis*, *arteritis deformans*, etc., intended to indicate the nature of the change undergone by the vessels.

**Causes.**—It is extremely rare before forty, and frequent after fifty. Men are probably more liable to it than women, but there is slight difference as regards sex. Various cachexiæ seem to hasten its devel-

opment. A fatty change occurs in the intima during the course of severe and prolonged anæmia. Chronic alcoholism, the poison of lead, gout, rheumatism, syphilis, etc., are supposed to be influential in developing the disease at an early period. Functional strain, in accordance with a well-known law, tends to excite arteritis; hence its early appearance in the aorta. Sometimes aortitis is derived, by contiguity of tissue, from endocarditis.

**Pathological Anatomy.**—The initial change consists in a proliferation of the connective-tissue corpuscles of the intima; the young cells crowd the space between the lamellæ, and, pushing up the intima, form a projection about a line above the general level. This abundant formation of new cells requires an amount of pabulum which can not be supplied, and hence the proliferating cells undergo a fatty degeneration. While this process is going on, a solution of the basis substance (the connective-tissue matrix) takes place.\* This change appears to the naked eye as yellowish or yellowish-white opaque spots or patches, distributed through the thickened elevations of the intima, which become soft and friable, and are gradually detached, leaving an abrasion, or "atheromatous ulcer." These abrasions may be coated with masses of fibrin, or blood-clot may form on and adhere to them. Coincidentally with the process of fatty metamorphosis, another process, beginning also in the sclerosed intima, develops. This consists in a deposition of calcareous material—the lime salts, chiefly—in the basis substance of the intima, and between the lamellæ. Plates of considerable size are thus formed in the aorta; they may be several inches in length, and of a curved shape corresponding to the aortic curve, and may extend over one half, even more, of the circumference of the vessel. Their rough surfaces project through the innermost lamella into the vascular lumen. These two processes very frequently coincide. The alterations taking place in chronic arteritis are not confined to the intima, but the media and the adventitia also participate. The unstriped muscular fiber undergoes fatty metamorphosis and calcification, or disappears by simple atrophy. In advanced cases the adventitia inflames, becomes infiltrated with cells, or undergoes fibroid degeneration. The results of arteritis are very important; when the small vessels are affected, their lumen is encroached on and may be entirely obstructed, or a large number affected to a less degree, the amount of blood passing to the district supplied by them will be much reduced, and important nutritive alterations must occur. The changes in the tunics of the vessels especially involve their elasticity, and they become mere rigid cords, through which the blood passes in jets. The loss of the power of elastic recoil exposes them to injury as the blood is driven through, and they slowly dilate or yield in places, forming

\* Rindfleisch, *op. cit.*, p. 211, *et seq.*

sacculi, or are torn outright. The increased resistance to the propulsion of blood, caused by these changes in the arteries, leads to dilatation and hypertrophy of the left ventricle. Named in the order of relative liability to arteritis deformans, are the aorta, the cerebral arteries, the coronary, the arteries of the extremities, and, lastly, the arteries distributed to the organs of vegetative life.

**Symptoms.**—The symptoms are obviously of a very diverse character when produced. Nothing is more usual than to see men after fifty with extensive atheroma, without a single symptom referable to it. Nevertheless, numerous and important consequences follow arteritis in some situations, and at certain stages of its development. Arteritis of the aorta, and the cardiac disturbances due to it, and arteritis of the brain, and the structural alterations produced by it, are the same as regards the arterial change, but are widely different in respect to the symptomatology. If the lumen of the aorta is encroached on, especially if very great narrowing takes place at the bifurcation of large arteries, or if extensive arterial districts have undergone sclerosis, the work of the heart to distribute the blood is so much increased that the organ undergoes hypertrophy. This change is indicated by the heaving impulse, by an extension of the area of cardiac dullness downward and to the left, and by accentuation of the second sound. Murmurs, due to regurgitation or stenosis, or both, may be audible with greatest intensity in the aortic area, when an extension of disease from the aorta to the semilunar valves, or to the endocardium, takes place. Weakening of the heart, dyspnoea, general oedema, may finally occur from degenerative changes in the heart-muscle, the result of atheroma and calcification of the coronary artery. The physical signs, then, of hypertrophy, from the causes above mentioned, must necessarily disappear and be supplanted by others when the aortic valves and the cardiac tissues become diseased. Dilatation of the ascending aorta may produce a pulsation in the right second intercostal space that may be mistaken for aneurism, and, if the dilatation be considerable, some dullness on percussion may be developed in the same position. The changes of arteritis deformans may be studied clinically in some superficially placed arteries, as the radial and the temporal; they are rigid, tortuous, irregular in size, and may be rolled under the skin like whip-cord. The tortuosity is increased during the systole, and lessens during the diastole, and the pulse is delayed—firm when the calcification is beginning, but becoming less and less recognizable as the artery degenerates into a calcareous tube. The loss of elasticity of the arterial tunics influences the sphygmographic tracing, which exhibits the same features as in albuminuria—rounded summits, oblique descent, without dicrotic or recoil wave. Advanced endarteritis leads to disastrous results in the nutrition of peripheral parts—the fingers and toes. In consequence of the diminished supply of

blood, the sensibility is low, the skin bluish, benumbed, and cold, and the least injury may set up destructive inflammation. A thrombus forming in the principal artery, dry gangrene will follow in the parts below, or in a small vessel of the foot; a single toe, or several toes, may slough off. Even more serious results follow endarteritis of the internal vessels. Thus, as has been pointed out in the article on gastric ulcer, solution of the mucous membrane and the subsequent formation of a chronic ulcer may have its origin in disease of an artery and thrombosis. It is a singular fact that, although the arteries of the vegetative organs are the last to be invaded by endarteritis, yet it occasionally happens that a small part of an artery supplying the gastric mucous membrane is the seat of this degeneration, with the disastrous effect above mentioned. But the arteries of the brain are much more widely and early affected by endarteritis than of any vessels except the aorta, and indeed this morbid process may begin in the brain. The dilatations of the arterioles and small arteries, known as miliary aneurisms, are the great cause of cerebral hæmorrhage; thromboses of the capillaries and small arteries induce local softening; endarteritis, without interrupting the passage of the blood through the lumen of the vessels, impedes the transference of the nutritive materials to the tissue of the brain, with the result of serious impairment of the nutrition of the organ, and consequent failure of mental power, and the usual objective evidences of cerebral mischief.

**Course, Duration, and Termination.**—The course of endarteritis is influenced by various circumstances. The progress of the change is hastened by the abuse of spirits, and by such cachexiæ as syphilis, rheumatism, and gout. It is very chronic, and its duration may be measured by years. As has been pointed out, many cases exist without causing any disturbance; others are very important in consequence of the lesions invited by arteritis. The termination is a question of the nature of the secondary lesions, and especially of the changes in the cerebral arteries. There is more danger in those cases occurring at an early period of life. For example, the author has seen life terminated by a small aneurism of the basilar artery, when this was the only spot where endarteritis existed.

**Treatment.**—Although, when the change has once taken place in an artery, nothing can be done to remove it, the author believes that the progress may be, if not arrested, at least retarded by proper treatment. There are three remedies of special importance in this disease; quinine, hypophosphite or lactophosphate of lime, and cod-liver oil. The phosphite or phosphate of lime, and the cod-liver oil, should be given, after meals—a teaspoonful of the sirup of either phosphate or phosphite, but preferably of lactophosphate of lime, and a teaspoonful of cod-liver oil. They may be given in an emulsion simultaneously, or one may follow the other, and they should be taken without failure

for months at a time. Quinia should be given in five-grain doses, morning and evening, on alternate days at various times. Personal habits contributing to arterial degeneration should be discontinued. A syphilitic taint should be corrected, and lead or other poison deposited in the tissues should be eliminated. The diet should be composed of nutritious materials, but indigestion ought to be avoided. Daily outdoor air and moderate exercise are very necessary hygienic measures.

#### ANEURISM OF THE AORTA.

**Definition.**—An *aneurism* is a tumor formed of the coats of an artery, and containing blood and fibrin. They are designated *cylindrical*, *fusiform*, or *sacciform*, according to their shape; and *true* if all the layers are engaged, *false* if one or two form the walls of the sac. A *dissecting aneurism* is one in which, the intima and media giving way, the blood dissects along underneath the adventitia, and the walls of the sac are composed of this membrane only. A *varicose aneurism* is one in which a communication is established with the venæ cavæ, the innominatæ, the right auricle, or the pulmonary artery. The anatomical distinctions on which these names are based are important chiefly from the prognostic point of view.

**Causes.**—The aorta is the favorite site of aneurisms, because, in the performance of its functions, it is subjected to great strain. If the left ventricle is hypertrophied, the blood-pressure in the aorta is increased, and the tendency to the formation of aneurism is greater. Powerful muscular effort has the same effect, and hence those who are engaged in occupations requiring the exertion of their utmost strength suffer more from this malady than those having easier pursuits. Men are more liable to the disease than women, and for the same reason that those who labor hard suffer more. The frequent association of syphilitic infection and aneurism has attracted much attention, but a causal relation has not yet been established. Chronic arteritis is, doubtless, the chief cause; the tunics of the vessel, weakened by the structural alterations, yield more and more under the force of the blood-pressure. To this view, which is generally accepted, is opposed the important fact that, while aneurism is most usual between thirty and forty, atheroma rarely sets in until after forty. On the other hand, it may be alleged that aneurism would be vastly more frequent if the changes in the structure of arteries occurred earlier in life; and, furthermore, in cases of aneurism, the existence of atheromatous degeneration can almost always be ascertained.

**Pathological Anatomy.**—In Sibson's\* collection of cases of aneu-

\* Sibson's "Medical Anatomy," London, 1869 (see columns 57-60).

rism occupying some part of the aorta, 880 in number, 703 were of the thoracic aorta, the others of the abdominal and its branches. Of these, 193 were of the ascending aorta, 87 occurring at the sinuses of Valsalva. This statistical fact is a confirmation of the pathological law that those parts most subject to strain in the ordinary course of functional work soonest become diseased. Next to the ascending part, comes the arch which was the seat of aneurism in 120, while only 72 were in the descending aorta. As regards the form assumed by the aneurism, two thirds of those affecting the ascending part are examples of the sacculated variety. It is a curious fact that, while aneurisms of either the ascending or transverse aorta are sacculated, those involving both parts of the vessel are cylindrical or fusiform (Sibson). In the descending aorta, the sacculated are about two thirds of the whole number. The direction taken by the aneurism of the ascending aorta is usually to the right of the transverse part, about one half toward the back, the other half to the right and front; of the descending, to the left and posteriorly.

The sac of the aneurism, which in the beginning is composed of the tunics of the vessel, or of the adventitia, is subjected to various pathological influences which alter its character. It is affected by atheroma, by calcification, but is still more changed in structure by attacks of inflammation which unite it to neighboring organs. The author has met with a case in which the proper sac had disappeared, and the walls were made up for the most part of the tissue of the left lung in which it was imbedded. The interior of the sac is altered by successive deposits of fibrin, differing in age, color, and density, and having a distinctly stratified arrangement. The oldest layers are grayish-white, tough, and firmly adherent to the inner surface of the sac, while the recent coagula contain more or less coloring matter, are softer, easily broken up and detached. By the gradual addition of layers of fibrin the sac is ultimately closed, and a cure is effected by the obliteration of the cavity. Sometimes the outermost layers of fibrin undergo calcification; sometimes an acute inflammation is set up and the sac is destroyed by suppuration. Occasionally blood-clots or masses of fibrin are cast off, with the effect to block the efferent vessel, or some of its tributaries, or, breaking up, are distributed as multiple emboli. The mischief caused by an aneurism is not limited to the sac itself, but involves neighboring organs by pressure, interfering with functions, or inducing inflammation, ulceration, and atrophy. The bronchi, œsophagus, or thoracic duct, may be opened by ulceration, or the vena cava occluded by a thrombus, or invaded by ulceration, thus producing an aneurismal varix, or atrophy of the neighboring lung may be caused by pressure. The ribs, sternum, and vertebræ may be eroded, and the spinal cord compressed. Important nerve-trunks are first irritated by the proximity of the tumor, next inflamed by pres-

sure, and ultimately so mixed in the elements of the sac as to disappear. If the aneurism occur in the sinuses of Valsalva, the aortic valves become incompetent by reason of changes in the orifice. It had been generally maintained that aneurism of the aorta causes hypertrophy of the heart, but Sir Dominic Corrigan, Professor Axel Key,\* of Stockholm, and others, have shown that "aneurism has no tendency to produce enlargement of the heart" (Corrigan); and, when hypertrophy coexists with aneurism, there is no causal connection.

Termination by rupture is the most common. As regards aneurisms of the sinuses of Valsalva, about eighty per cent. terminated by rupture; of the ascending aorta, fifty-seven per cent. ended by rupture; of the transverse, thirty-seven per cent.; of the descending aorta, seventy-five per cent. (Sibson). Rupture of the ascending aorta occurs into the pericardium (in one half of the cases), into the right auricle, into the lung, into the pleura, into the right bronchus, into the trachea, into the œsophagus, or externally; of the transverse portion, into the trachea, lungs, œsophagus, pleura, posterior mediastinum, pulmonary artery, or vena cava; of the descending portion, into the pleura, lungs, etc.

**Symptoms.**—The signs and symptoms of aneurism, as of cardiac diseases, are comprehended in two groups: rational and physical. The rational signs are symptomatic of the functional troubles caused by the aneurism, and, of course, vary somewhat with the position of the new formation. It will conduce to clearness to consider the subject of aneurism of the thoracic aorta and its main branches first, and follow with aneurism of the abdominal aorta and its main branches.

*Aneurism of the Thoracic Aorta.*—The earliest symptom is pain. This may be a fixed pain, almost constant, and felt in one spot under the sternum and in the neighborhood of the aneurism. More frequently the pain has a combined lancinating and tensive character, shooting up from the interior of the chest to the neck, to the shoulder, down the arm to the elbow, sometimes to both sides; or, it is felt in the back and shoots around the chest in the direction of the intercostal nerves. At times the attacks of pain are most severe, and demand the use of active anodynes. These pains, which occupy the trajectory of the cervical and brachial plexus, and of the intercostal nerves, ought not to be confounded with attacks simulating closely angina pectoris, which occur when the aneurism is near the heart. These paroxysms consist of præcordial pain and anxiety—pain shooting across the chest, in the præcordial region, and to the shoulder, down the arm. Although these attacks are due to the irritation of the nerve-trunks, they affect a different set of nerves, those supplying the heart itself. So constant is this symptom of pain, so severe and persistent, although paroxys-

\* The "Medical Times and Gazette," June 4, 1870.

mal, that, if it come on in a man of middle age without any explanation, aneurism should be suspected in the absence of more characteristic symptoms. There is also more or less dyspnœa, paroxysmal rather, in the initial period, and may occur without any apparent cause, from pressure on the pneumogastric when there is apt to be nausea associated with it, or to pressure on the phrenic, when there may be hiccough. In the further development of the aneurism, dyspnœa may be produced by pressure on the left primary bronchus, diminishing the air passing to the left lung or on the trachea, or to pressure interfering with the return of blood from the lung, and there may be simultaneously pressure on the pneumogastric, causing laryngeal symptoms, and on the phrenic, causing paralysis of the diaphragm. When the dyspnœa is due to pressure on the recurrent laryngeal, there will be associated with it peculiarities of the voice, cough, and breathing. When due to pressure on the trachea, it is somewhat relieved by inclining the head forward; and in one case, that of a physician seen by the author, a violent suffocative attack was brought on by raising the head erect. In other cases of pressure on either bronchus, relief to the breathing is afforded by turning to the opposite side. When the dyspnœa is due to direct pressure on the lung, there are present fever, profuse expectoration, etc., the signs of phthisis. When the aneurism is at the arch and springs from the inferior segment, pressure on the recurrent laryngeal will produce characteristic symptoms at an early period. If the pressure irritates without destroying the nerve, all of the muscles of the larynx innervated by it will be thrown into a state of spasm, with the effect to modify the voice and cough in a most characteristic manner. While one cord approximates its fellow and vibrates in the normal manner, the other is in a state of rigidity and does not vibrate normally, producing an odd effect on the voice, there being a double tone, one high-pitched and the other lower; but this *vox anserina* occurs with both inspiration and expiration. Alteration of the voice is much more common than aphonia. When the paralysis of the vocal cords is double, which is an extremely rare event, the voice is gone and there is aphonia; but, if, as is usually the case, the paralysis is of the left vocal cord, the voice has a harsh, stridulous character. The cough exhibits the same peculiarities. When the nerve is irritated without being destroyed, the cough is loud, resonant, and metallic—croup-like; on the other hand, when the nerve is destroyed and the muscles of the larynx paralyzed, the cough is suppressed, wheezy, stridulous. By laryngoscopic examination, the explanation of these phenomena is afforded in the character of the movements of the arytenoid cartilages and vocal cords. The effect of irritation is seen in the rigid state of one cord, which does not approximate accurately its fellow during phonation, and vibrates imperfectly if at all. When the destruction of the nerve is effected and paralysis comes on, the paralyzed

vocal cord is relaxed, wrinkled, and does not move up to its fellow during phonation, nor does the inspiratory dilatation take place on the paralyzed side. Irritation of the main trunk of the pneumogastric may, as has been pointed out, cause respiratory disturbances, paroxysms having an asthmatic character, etc., but the peculiarities of voice and speech above mentioned are only produced by lesions of the recurrent laryngeals, and chiefly of the left nerve. Several cases of bilateral paralysis of the larynx have resulted from the pressure on the nerve of one side only. Dr. George Johnson\* supposes this to be due to a reflex influence transmitted by the commissural connection between the nuclei of the spinal accessory, and this is most probably the true explanation, although it has been opposed.

The state of the pupil has a high degree of clinical importance. If the aneurism irritate the fibers of the sympathetic nerve without destroying them, this fact is signalized by permanent dilatation of the pupil; but if the nerve-fibers are destroyed, paralysis of the radiating fibers of the iris ensues, and hence contraction of the pupil follows (the third pair unopposed). Usually spasm of the glottis (irritation of the inferior laryngeal) coincides with dilatation of the pupil (irritation of the sympathetic); but this relation is not invariable, for spasm of the glottis may be present with contracted pupil (Russell). Unilateral sweating of the head and face is a symptom which occurs in a small proportion of cases, and may or may not be coincident with changes in the pupil. The sweating is strictly limited to one side of the head and face, and, although increased by external warmth and exercise, comes on quite independently of external conditions. It is supposed to indicate irritation of the sympathetic, but the real nature of the phenomenon is as yet unknown. As unilateral sweating is produced by a variety of causes, it is of importance in this connection only when it coincides with other and more definite signs.

The character of the cough associated with laryngeal troubles has been mentioned. There is also cough when the lungs are involved, and sometimes profuse expectoration. Cough is a symptom of pressure on the trachea or bronchi. Expectoration of blood from a minute communication between the sac of the aneurism and trachea is one of the puzzling symptoms, for it may have all the characteristics of an ordinary pulmonary hæmorrhage. This escape of blood may continue for several weeks by a circuitous channel, before rupture finally occurs. Dysphagia or difficulty of swallowing is produced by the same mechanism as the laryngeal spasms: irritation of the pneumogastric is reflected over the motor branches distributed to the œsophagus. This does not continue a permanent disability, but persists for a few hours, then disappears, to return again at some uncertain period. Pressure of the

\* "The British Medical Journal," December 19, 1874.

aneurism on the œsophagus produces a more permanent dysphagia, and, as might be expected, is a more common symptom in aneurism of the descending aorta than in any other position. According to the statistics of Sibson, dysphagia was present in thirty-five per cent. of cases of the descending aorta, in thirty-one per cent. of those of the arch, and in only two per cent. of those of the ascending aorta. As the aneurism enlarges, important symptoms are produced by pressure on the great vessels. If the descending cava is obstructed, bilateral œdema of the face and arms follows, or, if the innominate only is compressed, the effusion is limited to the right side or to the left side, according as it is the right or left vein. When the right auricle is impinged on, there must ensue cyanosis, general venous stasis, and dropsy; when the left auricle, pulmonary congestion with its consequences—brown-red indurations, hæmorrhagic infarctions, etc. Dilatation of the lymphatic vessels will be produced by the pressure of an aneurism occupying the last portion of the arch and the descending aorta.

When an aneurismal tumor protrudes at the thoracic wall, the diagnosis by the physical method becomes much simplified. By palpation, the existence of a tumor, pulsating and swelling with each pulsation, is made out. The first beat is stronger and more prolonged than the second, if there are two, and is a little subsequent to the heart-beat, while it anticipates the radial pulse. The second corresponds to the diastole of the heart, and is the recoil from the closure of the aortic valves, and of course is indistinct or wanting when the aortic valves are incompetent. A double pulsation exists only in the case of recent aneurism, and of the thoracic aorta; old aneurisms, lined with thick layers of fibrin, or composed of bony tissue, can not be thrown into vibration by the comparatively feeble force of the recoil wave, and abdominal aneurisms lie at too great a distance. Palpation also reveals a peculiar thrill or tremor which is intermittent, or is synchronous with the first beat, and is known as *aneurismal thrill*. It is obvious that, to feel this, a tumor must be very superficial, and without dense, thick, or bony walls. In the case of aneurisms deeply placed in the thoracic cavity, these symptoms ascertainable by palpation are wanting. Dullness on percussion is elicited only when the aneurism has attained sufficient size or is in a position to cause the reaction, and it exists over a very limited area under any circumstances. The usual position of the dullness is on the right of the sternum, parallel with the second or third rib; or it is at the sternum, or to the left of the sternum, and posteriorly to the left of the spinal column. This symptom does not afford precise indications, since the dullness of aneurism does not differ from that caused by any tumor, or by a solid organ, or by a purulent depot. On auscultation we hear in aneurism a systolic and diastolic sound or shock, such as is audible over the artery itself. These sounds correspond to the pulsations, with the excep-