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The heart supplies the motive power by which the blood is carried through the lungs and system, and as the nutrition and proper functional activity of every part and organ are dependent on the due supply of blood, diseases of this organ are attended not only with danger to life, but with serious consequences of the most varied kind. It may be said to consist of two hearts, pulmonic or right, and systemic or left, each having a receptive and an expulsive cavity, named the auricle and ventricle respectively, and the movement is communicated to the blood by the successive contraction or systole \( \Sigma\nu \sigma\tau\epsilon\lambda\nu \) - to contract], and dilatation or diastole \( \Delta \iota \sigma\tau\epsilon\lambda\nu \) = to dilate] of the ventricles, the valves at the auriculo-ventricular openings by which the blood enters the ventricles, preventing its return into the auricles during the systole, and those at the arterial orifices by which it is expelled, preventing its return into the ventricles during their diastole. The auricles, while mainly acting as reservoirs for the blood arriving by the systemic and pulmonary veins are not absolutely passive; their walls, though comparatively thin, are muscular; and when distended they contract and drive on their contents into the ventricles. A cardiac revolution, as it has been called, may be thus described:—Beginning at the moment of repose about the end of diastole, the ventricles are dilated* but not distended, and are full of blood which has entered from the auricles, the auricles also are full with the great veins leading to them; at this moment the heart has a generally rounded appearance, and the apex in particular is less pointed; the auricles, and especially the right, bulge out, and the auricular appendices are seen projecting.
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Forwards round the pulmonary artery and aorta. The auricles now suddenly and swiftly contract, sending their contained blood into the ventricles, which themselves immediately contract more slowly but with far greater energy, driving the blood into the arteries. During the ventricular systole the apex of the heart is twisted to the right and tilted forwards, giving rise to the apex-beat, while the right ventricle, the part of the heart in contact with the thoracic parietes, communicates a push or impulse which may usually be felt between the apex-beat and the sternum. At the same moment the segments of the mitral and tricuspid valves, which were free to move, spontaneously take up a position closing the orifice, in consequence of the disposition of the elastic fibres at their auricular surface, are forced into close contact, rendered tense, and made to bulge into the auricles by the pressure of the blood, so that from this, and from the continuous arrival of blood by the veins, the auricles are at once again distended. The end of systole thus finds the auricles full, while the ventricles are contracted and empty, and the body of the heart is angular and the apex pointed. The ventricles now suddenly relax, exercising a certain amount of suction power, and partially unloading the auricles; while for the remainder of the diastole both auricles and ventricles are passively distended by the blood flowing in from the veins till the moment arrives for a new systole.

On practising auscultation over the cardiac region we can detect two sounds, very quickly following each other. They are succeeded by an appreciable period of silence. If the time occupied by the sounds and the pause be divided into fifths, we shall find the first sound occupying two-fifths, the second sound rather less than one-fifth, and the pause rather more than two-fifths. The first sound, sometimes called the systolic or inferior sound of the heart, should be listened to over the apex: it is dull, booming, and prolonged, and is coincident with the systole of the ventricles, and impulse of the apex against the thoracic parietes. The second sound, often termed the diastolic or superior sound, is best heard about the middle of the sternum: it is short, abrupt, and clear; and is synchronous with the flow of blood from the auricles into the ventricles, the diastole of the ventricles, and the retroussement of the apex.

All physiologists agree in regarding the second sound of the heart as due to the brisk tension of the semilunar valves at the orifices of the aorta and pulmonary artery, to which must be added tension of the walls of these great vessels. The cause of the first sound, however, has long afforded a subject for controversy. By different eminent authorities it has been said to be due, entirely or partially, to the following:—The collision of the particles of blood with each other, and with the heart's parietes. The rush of blood through the narrowed openings of the great arteries. The impulse of the heart's apex against the thoracic walls. The
tension of the auriculo-ventricular valves, and the muscular bruist produced by the contraction of the muscular fibres of the heart.

There can be little doubt that the two main elements of this sound are, one, the tension of the auriculo-ventricular valves and their chordæ tendineæ; the other, the sudden tension of the muscular walls of the heart at the moment of contraction. The latter factor is not the grunts muscularis, which is a continuous rumble, but a sound of a different character, which may be illustrated by placing the stethoscope on the flexor muscles of the forearm, and throwing these into sudden powerful contraction. The two elements can be partially discriminated in the normal state of the heart, and in disease one or other may predominate—the valvular when the heart is dilated and weakened, the first sound being then short and sharp; the muscular in hypertrophy, when it is prolonged and booming.

The heart lies near the centre of the thorax but projects more to the left than to the right. It is partially covered by the lungs anteriorly, but the pericardium lies in contact with the walls of the chest to a certain extent, giving rise to dulness on percussion. The area of cardiac dulness is, however, small as compared with the size of the heart; its boundary on the right nearly corresponds with the right edge of the sternum from the second intercostal space downwards; on the left it runs near the left edge of the sternum to about the third space or fourth cartilage, when it turns sharply outwards, runs obliquely downwards within the nipple-line to the position of the apex beat which is in the fifth space about an inch below, and to the inner side of the nipple. The lower boundary runs nearly horizontally inwards to the sternum from the apex. The area of dulness then would comprise in addition to part of the sternum only the fourth and fifth left cartilage for 1 ½ or 2 inches from the sternum, and the third, fourth, and fifth spaces.

All the valves lie beneath the sternum about opposite the third intercostal space; the pulmonary almost directly in front of the aortic but somewhat higher, the tricuspid to the right, the mitral to the left and deeply seated near the spinal column. Fortunately for diagnosis, sounds produced at the mitral orifice are conducted by the ventricular walls to the apex, and again aortic sounds become more audible when this vessel has escaped under cover of the pulmonary artery and lies near the anterior wall of the chest at the second right intercostal space.

Physicians in all ages have very properly attached considerable importance to the rate and force at which the circulation is carried on. As a measure of these conditions, as well as of the quantity of blood sent forth at each contraction of the heart, appeal is usually made to the pulse as felt by the finger placed over the radial artery at the wrist.
The pulse is a resultant of three factors, the ventricular systole, the elasticity of the great vessels, and the resistance offered to the passage of the blood by the capillaries and minute arteries. On the ventricular systole depend the frequency, strength or force, and regularity; to the elasticity of the aorta and its main branches is due the conversion of the blood-stream from the intermittent jets in which it issues from the heart into a more or less continuous current; the capillary resistance and arterial contraction effect most important modifications which have very great significance.

When the minute arteries are contracted, the resistance to the transmission of the blood brings about a condition of high tension throughout the arterial system, and the heart requires more time to force the blood into the aorta against this pressure; the pulse consequently is long, and unless the heart is acting feebly, hard or firm; in extreme cases the radial artery can be rolled under the finger like a cord, even when there is no degeneration in its coats. The most frequent and striking illustrations of this condition are met with in contracted granular disease of the kidneys.

When on the contrary the arterioles are large, and the capillaries unresisting, the blood shoots rapidly through them and is not detained in the arteries, the tension in the arteries is low, the heart empties itself easily and quickly into the aorta and the pulse is short and soft; it may have what is called a bounding character, for in the intervals between the pulsation the artery is emptied and flattened by the pressure of the finger, and then the sudden rush of blood conveys a sensation as of great power to the observer. This is the pulse of febrile conditions.

Now the pulse of the adult in health beats about 75 times in a minute, and some considerable practice is needed to enable the observer to appreciate the characters of each of these pulsations. But if this be true, how much more difficult must it be in disease, with a pulsation frequently occupying less than half a second? To remove this difficulty recourse has been had to mechanical appliances. Vierordt was the first physiologist to invent an instrument capable of conveying the impulse from an artery to a lever which should mark the movement on a revolving cylinder of paper. This instrument is called a sphygmograph. The traces made by it are regular, and mark only the extremes of dilatation and the number of pulsations in a given time. A misfortune also is that its application is difficult. Hence, endeavours were made to produce a piece of mechanism which could be easily used, and which should produce a trace representing the shades of dilatation and contraction of the vessels. M. Marey has supplied this want; and his sphygmograph, substantially the one now used, accurately and minutely records the movements of an elastic steel pad pressed upon the artery. By this instrument, placed upon the arm over the radial artery, a trace can be procured on paper showing the form and duration and regularity of the pulsations. This trace presents a line of
ascent, a summit, and a line of descent, and exhibits in the pulse three elementary waves or impulses, which have been well named by Mr. Mahomed the "percussion," "tidal," and "dicrotic" waves. When the ventricles contract, all the arteries are suddenly distended, and a wave movement is propagated along the arterial system, producing the line of ascent, or the percussion wave. The more powerful the action of the heart and the more rapid the entry of blood into the arteries, the more vertical will be the ascent and the more marked the percussion wave, while it is diminished by fatty degeneration or other causes of weak or sluggish contraction, and is annihilated by aneurism. The tidal wave is the true pulse wave, and is caused by the expulsion of the ventricular contents into the arterial system: in the trace it is represented by the arrest in the fall of the lever after the percussion, and a more or less horizontal prolongation, or even a gentle rise. If the arteries and capillaries are relaxed so that the blood escapes rapidly the tidal wave is short; if they are contracted so as to resist the passage of the blood the tension in the arterial system is rendered high and the tidal wave is sustained. The dicrotic wave, represented in the sphygmographic trace by an interruption in the descent and a more or less conspicuous secondary rise, is due to the elastic recoil of the aorta from its sudden distension by the systole of the ventricle; it is most marked in conditions of low arterial tension.

The sphygmograph is frequently of service in the diagnosis of diseases of the heart and of aneurism of the great vessels, but is of far greater value in exhibiting the degree of tension within the arterial system under various conditions. In febrile states the tension is usually low, as is shown by a short tidal wave and by well-marked dicrotism: in Bright's disease, and in conditions of the system tending thereto, the tension is high, the tidal wave being sustained and the dicrotic wave slight or absent.

I. PERICARDITIS.

Pericarditis [περικαρδίτις — περικαρδίτις about + καρδία = the heart; terminal -ίτις], or inflammation of the external fibrous covering of the heart, may be regarded as a local manifestation of constitutional disease, save in those few instances where it is the result of mechanical irritation or injury. The morbid action varies much in degree in different cases; sometimes being so slight as to give rise to scarcely appreciable symptoms, while at other times both the local and general effects are most distressing.

Causes. — This disorder most frequently arises from acute rheumatism, but it is not uncommonly caused by the contaminated state of the blood produced by renal disease, sometimes apparently
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by damp or cold, or by mechanical injuries. As regards acute rheumatism, probably one case in nine or ten will be complicated with pericarditis. The tendency to cardiac complication in rheumatism diminishes with increase of age after fifteen. Dr. Ormerod reduces all cases of pericarditis to two classes:— 1. Rheumatic pericarditis; 2. Non-rheumatic pericarditis. In the first, the disease is always well-marked, it is associated with affections of the joints, women appear rather more subject to it than men, it is most common in the young and delicate, and it is rarely directly fatal. With respect to the second, the inflammation occurs at a later period of life, is most common in men, occurs most frequently in bad constitutions, and is very often the cause of death. Non-rheumatic pericarditis may be due to cancer, tubercle, incised wounds; the formation of a fistulous opening between a cavity in the lung and the pericardial sac, the extension of pleurisy to the pericardium or penetration of hepatic abscess through the diaphragm to the pericardium, &c.; or it will arise from a particular constitutional cause,—disease of the kidney, scurvy, pneumonia, pyaemia, or one of the fevers.

Pathology and Morbid Anatomy.—The pericardium becomes vascular and loses its polish; it may present points of hemorrhage. Effusion then takes place, which may vary greatly in character, being either on the one hand almost purely serous, or on the other almost entirely composed of coagulable lymph, or of a mixture of the two in any proportion. The lymph may take the form of flocculi and strings when scanty, or when abundant may coat the heart with a thick layer which by the movements of the organ becomes rough and sponge-like. The appearance has been compared to that seen when a knife is pressed on soft butter and withdrawn. In some cases—usually when there is some form of blood poisoning, it is purulent. In severe cases the muscular walls of the heart are often involved, and their substance is darker in colour than natural and more lacerable. The results when not immediately fatal may be adhesion, partial or complete, between the heart and pericardium; or the formation of layers of tough membranes, sometimes even calcareous patches. Not uncommonly complete absorption of the exudation occurs, and no trace may be left, or only opacities and slight thickenings. The white patches often seen on the anterior surface of the heart have been attributed to pressure, and have been named the soldier's and coeber's white spot. When pericarditis has lasted long the muscular walls of the heart are liable to become weakened and undergo dilatation, which may be compensated later by hypertrophy. When adhesions have occurred the heart may remain unchanged, or become hypertrophied if the play of the organ is interfered with; occasionally atrophy has been met with.

Symptoms.—There is a considerable difference in the nature and
degree of the symptoms; for while frequently they are so slight that the disease escapes detection unless specially looked for, in other cases they are strongly marked. When pericarditis comes on in the course of rheumatic fever or other acute affections, and entirely a slight exudation of fibrous has taken place, or when the serum thrown out has been rapidly absorbed and adhesions early effected, there may be nothing to indicate its occurrence, or there may be only a sense of oppression in the precordial region, with tenderness on pressure, palpitation, and increased frequency, or especially an abnormal sharpness of the pulse. The respiration may also be irregular or sighing or excited. Severe pain is extremely rare unless there is pleuritic complication. When, however, there is much co-existent myocarditis, then both the local and general symptoms are rendered much more decided. Thus, in these latter instances, there will probably be high fever; pain referred to the region of the heart, often darting through to the left scapula, upwards to the left clavicle and shoulder, and down the arm; violent palpitation, the motions of the heart being tumultuous, and perceptible an distance from the patient; irregularity of the pulse, usually with great frequency; hurried respiration; incapability of lying on the left side; strong pulsation of the carotids; anxiety of countenance; with frequently, noises in the ears, giddiness, and epistaxis. Again, when effusion takes place the heart's motion is interfered with; the patient is extremely restless and anxious; the pulse becomes frequent and small; there is dyspnœa, due partly to the enfeebled circulation, partly to the pressure on the left lung by the distended pericardium. Sometimes the patient is compelled to sit up in bed and lean forward in a position which is very characteristic. As the disease advances, there is extreme debility; with a perceptible dicrotism of the radial pulse, cough, suffocative paroxysms, and occasionally a tendency to syncope. The face is puffed and dusky and has a most anxious and distressed expression; there may be œdema of the extremities. Sometimes a state of asthma resembling that of fever may be induced, and occasionally there is violent delirium which may completely mask the symptoms of cardiac disturbance. The heart's action also becomes much weaker, the impulse irregular and trembling, and the sounds get weakened and altered in character.

The uncertainty of the general symptoms of pericarditis makes it all the more necessary that in every instance where the occurrence of this disease is feared, the physical signs which indicate its commencement should be carefully watched for. On practising auscultation we shall find, during the earliest stages, increased intensity of the natural sounds. Very early a distinct alternate rubbing or a to-and-fro sound, as Sir Thomas Watson terms it, will be audible, due to friction between the roughened surfaces of the cardiac and parietal layers. It varies extremely in intensity and
in character, and is not always double or to-and-fro, but may be
systolic or diastolic only in time; it commonly ceases in a few
days, when either adhesion between the two roughened surfaces of
the membrane takes place, or when effusion happens. Every now
and again it will be noticed that the friction-sound continues here
and there audible, particularly about the base of the heart, though
the effusion is copious; and sometimes it may be reproduced by
pressure with the stethoscope when it had disappeared, the
pressure displacing the fluid and bringing the two surfaces again
into contact. The exocardial friction-sound may so closely simu-
late endocardial murmur that it is sometimes difficult to dis-
tinguish between the two. Moreover, it is probable that a
full development of the friction-sound can only take place when
both divisions of the pericardium are the seat of plastic exu-
dation.

Where serous effusion occurs, there will be a feebleness and
deficiency of tone and force in the heart’s sounds, probably owing
to the deadening influence of the fluid surrounding the heart.
There will also be increased dulness on percussion in the cardiac
region; this may first be detected across the upper sternum about the
level of the third costal cartilage, the heavy heart displacing the
fluid to the upper part of the pericardial sac, which is moreover
here distensible and superficial. As the amount of fluid increases
dulness is found to the right of the lower sternum and to the left
beyond the situation of the apex beat, and it may extend upwards
as high as the second rib. The effusion may become so extensive
as to give rise to distinct bulging of the precordia and compres-
sion of the left lung. Sometimes a fluctuating movement is per-
ceived with the heart’s impulse, but this appearance may be pro-
duced otherwise and is liable to mislead. If the fluid does not
become absorbed, we say that hydro-pericardium exists; a dropsical
affection which sooner or later usually proves fatal. Only when
the friction-sound is loud will it be sensible to the touch; since a
more powerful rubbing is needed to produce a tactile than an
audible phenomenon.

If we classify the physical signs and symptoms of pericarditis,
the arrangement will be as follows:—(1) Sensations of friction
appreciable to the hand. (2) Friction-sounds: of short duration.
(3) Extension of limit of cardiac dulness: not the consequence of
œdema or congestion of the heart, but of the liquid effusion.
(4) Signs of excitement or irritation of the heart. (5) Signs of
loss of power or even paralysis of the heart.

The sac of the pericardium is now and then obliterated, owing
to adhesions between its free surfaces.

Diagnosis.—This will turn mainly on the distinction between the
valvular murmurs of endocarditis and exo-cardial friction-sounds,
and between dulness occasioned by hypertrophy and that from
effusion into the pericardium. Frequently a friction-sound is
unmistakeable; when there is any difficulty it may usually be decided whether a doubtful sound is endocardial or pericardial, by bearing in mind that a friction-sound is not conducted far from the point of its production, and is often heard over a very limited spot, while it ceases to be heard when the ear is withdrawn from close contact with the stethoscope, whereas a valvar murmur continues to be audible at a certain distance from the stethoscope, and is conveyed towards the axilla, or along the aorta, and is often heard in the back. The most conclusive test, however, is to apply pressure with the stethoscope, when a sound due to friction will be intensified and altered, and will frequently assume a to-and-fro character, while the only effect on a valvar murmur will be to render it clearer by condensing the tissues and thus improving the conduction of the sound.

Prognosis.—Pericarditis, and especially the rheumatic variety, is not so much to be feared for its immediate danger, as for the traces of permanent injury which it leaves behind. The endocarditis that so frequently accompanies it, especially produces serious mischief to the valves of the heart. Hence an individual, after apparent recovery, seldom finds himself as strong or hearty as he was before the attack: he suffers occasionally from cough and shortness of breath, together with palpitations of the heart on moderate exertion. Sometimes the symptoms remain latent for a few years; that is to say, they are not appreciable to the patient, who flatters himself that he is free from all traces of his attack. But after a time (much shorter in those who have to work hard for their daily bread, than in the well-to-do members of society) the health begins to fail; the general weakness, difficulty of breathing, and palpitations return: dropsical symptoms set in; or perhaps an attack of inflammation takes place, and proves fatal. Adherent pericardium again with its effects upon the heart walls is one of the causes of sudden death.

Treatment.—In no disease was the lancet used with a more unsparing hand only a few years since, than in inflammation of the pericardium. More extended experience has proved to us, however, that this heroic and sure method—as it was deemed—of extinguishing the morbid action, is not only uncertain, but often very dangerous. Dr. Markham well says, “Experience has also shown us that venesection has no directly beneficial influence over pericarditis; and that large bleedings are prejudicial, and therefore inadmissible in this disease. Nevertheless, that small bleedings are often of very great service in relieving the congestions of the heart and lungs, which so often arise as consequences of and coincidently with the pericarditis, is, I think, an undoubted fact.”* Then we were also taught the great importance of rapidly getting the system under the influence of mercury after bleeding; but the

observations which have already been made upon this head render further remarks unnecessary here.

The treatment which was first advocated in the third edition of this work, published in 1857, and which I have since continued to adopt, is that practised by many for the relief of acute rheumatism—the three principal remedies being the bicarbonate of potash in doses of thirty grains every two or three hours, opium in insufficient quantities to relieve pain and restlessness, and the vapour bath. Locally, poppy and chamomile fomentations, or very hot linseed poultices, are decidedly useful. From these agents I believe that I have seen the greatest benefit; and certainly in no instance have they been prejudicial. They give considerable relief to the patient’s sufferings without inducing debility; and they in no way complicate the symptoms. The quantity of opium which may be needed, will vary with the severity of the suffering; but usually full doses (perhaps one grain every three or four hours) are wanted. Now and then a single vapour bath suffices: in other cases it is necessary to repeat it daily, for three or four times. Alkaline drinks (F. 355, 356, 360) are also refreshing and do good. In most cases it will be necessary to administer a few doses of some purgative: the neutral salts (F. 141, 148, 150, 166) generally agree well. For pericarditis from a punctured wound, or that due to the extension of mischief from adjoining organs, any treatment beyond the administration of opium and the ordering of perfect rest, can only tend greatly to diminish the chances of recovery.

At the commencement of the attack the nourishment should be light, consisting of gruel, arrowroot, milk, and mutton broth. Directly the strength begins to fail, however, the diet must be made more strengthening; and soup, strong beef tea, and wine freely allowed. Dr. Stokes states that he is convinced patients are often lost from want of stimulation at the proper time; and he directs us to give support directly the pulse becomes feeble or intermittent, or the jugular veins appear turgid, or pallor and coldness of the surface set in, or a tendency to faint upon exertion is manifested. He says,—“It may be laid down as a general principle that there is no local inflammation whatever, the mere existence of which should prevent the use of wine, if circumstances require it. In two cases especially—namely, cerebritis and pericarditis, we find the greatest timidity in practice with respect to the use of wine. Yet even in the first case it may be required; and in the second its employment is imperative, when, as too often happens, excessive depletion has been resorted to.”* Absolute repose of body and mind, in all cases, is important.

When the effusion into the pericardium is abundant, a large blister should be applied over the precordia; or a succession of smaller blisters will perhaps answer the same purpose. The iodide

* The Diseases of the Heart and the Aorta, p. 88. Dublin, 1856.
of potassium (F. 31) has been advantageously administered to promote absorption. It has been proposed as a forlorn hope in obstinate hydro-pericardium, to remove the fluid by the introduction of a trocar and cannula, and several successful cases have now been recorded. M. Aran, Physician to the Hôpital St. Antoine at Paris, relates a case of pericarditis with copious effusion, in a young man aged 23, which he treated by an injection of iodine. The pericardium was punctured from below upwards, with a capillary trocar, in the fifth intercostal space, a little beneath the spot where the dulness on percussion was well marked: about twenty-eight ounces of a transparent reddish serum were removed. A mixture formed of four drachms of tincture of iodine, fifteen grains of iodide of potassium, and an ounce and a half of water, was then injected without causing any pain; a drachm or two being allowed to escape before closing the wound. The fluid having reaccumulated the operation was performed a second time, at the end of twelve days, giving outlet to forty-nine ounces of a greenish-albuminous fluid; a stronger injection then being employed, formed of equal parts (fl. drr. xii) of tincture of iodine and water, with sixty grains of iodide of potassium. The treatment was successful.*

II. ENDOCARDITIS.

Endocarditis [from ἔνδος = within + καρδιὰ = the heart; termina1 -itis], or inflammation of the whole or of a part of that delicate membrane which lines the interior of the heart and its valves, is of great interest to us as pathologists and physicians, owing to the severe organic diseases that so constantly spring from it. It rarely attacks the right cavities, except during intra-uterine life, and in the left affects chiefly the valves.

Pathology and Morbid Anatomy.—Inflammation of the endocardium is most commonly associated with acute rheumatism, sometimes with scarlatina, puerperal fever, or other acute affections, or with kidney disease. It may also occur in a gouty condition of system, when it will generally be chronic, or chronic inflammation of the valves may be the result of the continual strain upon them occasioned by certain occupations, as in colliers, hammermen, or coal heavers. Dr. Hope was of opinion that in rheumatic fever endocarditis more frequently occurs without pericarditis, than the latter without the former. Dr. Stokes has come to a different conclusion, and he places these diseases in the following order of frequency:—1. Acute pericarditis with endocarditis; 2. Acute pericarditis without endocarditis; and 3. Endocarditis.

without pericarditis. It is certain, however, that endopericarditis is more frequently met with than simple endocarditis.

In endocarditis, as seen in the valves, there is at first some vascular injection, and thickening due to proliferation of the cells underlying the epithelium, but very soon so-called vegetations are observed—minute deposits of lymph, which in the semilunar valves usually form a crescent near the free edge, in the aortic and ventricular valves stud the thin margins and chordae tendineae. To these, which arise from endocardial cells, will be added fibrin from the blood coagulated by contact with the roughened and inflamed structures. The fibrinous deposits may become detached either in molecular particles, or in mass, and being carried away by the blood current may become impacted in the capillaries or arteries of the brain, lungs, spleen, or other internal organs, when paralysis or gangrene, or various consequences may result. This is most likely to occur in ulcerative endocarditis. Later, the usual developmental changes occur in the inflammatory products through which the valves and chordae tendineae become opaque, rigid, contracted, or adherent, and not uncommonly calcified, giving rise to constriction of the orifice, or incompetence of the valves; occasionally ulceration occurs, when the valves may be perforated or otherwise extensively destroyed. Sometimes again the endocardium lining the ventricle being attacked by ulceration the muscular structures may be bulged out or destroyed, giving rise to one form of cardiac aneurism. In chronic endocarditis, which has lately been shown to be largely due to strain, there is proliferation of the connective tissue elements with thickening and opacity, and later degeneration, giving rise to contraction, puckering, induration, or calcification.

Symptoms.—Endocarditis occurring in the course of rheumatic fever, or other acute disease, does not betray itself by any very marked symptoms. There will usually be some acceleration of the pulse, often an undue frequency of respiration, and a somewhat anxious expression of the face, but as a rule there is little or no complaint of pain. The heart ought therefore to be regularly examined during the course of acute rheumatism or other disease in which a liability to endocarditis exists without waiting for local indications. The disease is seldom directly fatal; its remote effects being those so much to be dreaded. When, however, endocarditis comes on as an isolated and independent affection, it is often severe and not uncommonly fatal. In very severe instances the inflammation chiefly gives rise to a sense of oppression and uneasiness at the precordial region; while the patient prefers to lie on his back, and is restless and anxious. There will be fever, with a small and feeble and intermittent pulse; while there may be also cold sweats, oppressive dyspnoea, jactitation, and syncope. In ulcerative endocarditis, which is most liable to give rise to these marked
ENOOCARDITIS.

... symptoms, there will usually be also purpuric spots on the skin from capillary embolism, and sometimes blocking of larger vessels.

**Physical Signs.**—Upon applying the hand to the chest in simple endocarditis, the action of the heart may appear to be violent; while sometimes a vibratory thrill will be felt.

- Percussion, it is said, often discovers an augmented extent of dulness in the precordial region; this dulness being distinguished from that caused by pericardial effusion, by the beat of the heart appearing superficial instead of remote and distinct. But it is very doubtful if simple endocarditis can ever give rise to so much tumefaction or congestion of the walls of the heart, as to produce such an increased degree or extent of dulness as could be appreciated on making the usual examination.

Auscultation alone affords us any reliable information. On listening to the heart's sounds, we shall usually detect a soft bellows-murmur, the most constant and characteristic of the phenomena of endocarditis. It is not always easy, however, where pericarditis exists to distinguish between an exocardial and an endocardial sound. The characteristic features of each have already been pointed out when treating of pericarditis, while when it is certain that a valvular murmur is present, it may be perplexing to determine whether this is the consequence of old or recent mischief. Supposing that during the progress of an attack of rheumatism a murmur is found where none existed before, we of course cannot be wrong in diagnosing endocarditis; but when the patient has previously suffered from acute rheumatism, and a murmur is heard when he first comes under observation, there may be considerable doubt. If the murmur is most audible over the base of the heart, the aortic valves will be the seat of inflammation, giving rise to obstruction if it be systolic, to regurgitation if diastolic. If the murmur is best heard at and to the left of the apex-beat, the mitral valve is affected. Inflammation, however, may go on for some time without giving rise to a murmur. For the further consideration of the physical signs of the various valvular lesions see the section on the Diseases of Valves of the Heart.

To recapitulate, the questions to be decided by auscultation are these:—Is the abnormal sound exocardial or endocardial? If the latter, is the murmur old or recent? Allowing it to be recent, is it aortic or mitral; or is there a double bruit owing to the valves at both orifices being affected? Primary disease of the pulmonic and tricuspid valves is so very rare, that the consideration of such need not here be allowed to complicate the points for scrutiny. Then finally, is it obstructive or regurgitant disease, or aortic obstructive and mitral regurgitant together; or aortic obstructive and regurgitant together?
Treatment.—This must be conducted on the same principles as should guide the practitioner in the treatment of pericarditis. Owing, however, to the power of ammonia in preventing deposition of fibrin, it is very advisable to administer full doses of the carbonate or the aromatic spirit of this salt, from the commencement of the inflammation.

III. MYOCARDITIS.

Myocarditis [from μυς—a muscle + καρδία—the heart; terminal -itis], carditis, or inflammation of the muscular substance of the heart, seldom occurs as a distinct affection; being generally combined with pericarditis, or with endocarditis, or with both. The morbid action, it is probable, extends from the investing or the lining membrane to the muscular substance; though our present knowledge will not justify our denying that the starting-point of the inflammation may be in the muscular fibres themselves. The walls of the left ventricle seem to suffer more frequently than other parts of the heart.

Pathology and Morbid Anatomy.—The muscular substance of the organ is at first dark-coloured; later it becomes pale and soft, the fibres losing their striated appearance, and breaking up. An abscess may result, or the wall of the ventricle may yield and form an aneurismal dilatation, or if the inflammation has been limited to small portions, these may become pale indurated patches.

Dr. Latham met with an almost unique case of universal carditis, in which there was effusion of pus generally throughout the cardiac fibres. The whole heart on being opened was seen to be deeply tinged with dark-coloured blood, while its substance was softened. Here and there, upon section of both ventricles, innumerable small points of pus oozed from among the muscular fibres. This was the result of most rapid and severe inflammation; death having occurred after an illness of only two days.

The report of another notable instance of inflammation of the muscular substance of the heart has been published by Mr. Salter.*—In this case, the disease ran its course in seven weeks. It commenced with an acute pain in the left side of the chest; which came on when the patient was walking, lasted a short time, and recurred about a week afterwards whilst he was using the same exercise. The pain subsequently became very frequent, and was induced by the slightest exertion. When Mr. Salter first saw him, about a week before his death, there was orthopnoea, and an uneasy sensation or dull aching referred to the stomach and middle of the sternum. Venesection, calomel and opium, with counter irritation were the means adopted to stay the disease;

but they were unavailing, and death took place. At the post-mortem examination the pericardium was found inflamed, especially in its diaphragmatic portion; its vessels were distended, and spots of echymosis were discovered beneath the serous membrane. The substance of the heart was moderately firm; but the left ventricle had almost entirely lost the colour of muscle, pus could be scraped from its surface, and in some parts there were cavities in the muscular substance like small abscesses.

The history of an example of acute inflammation of the muscular structure of the heart without any inflammation of the endocardium or pericardium, was detailed to the Fellows of the Royal Medical-Chirurgical Society by Dr. C. B. Radelilfe in 1805:—The patient was a strong middle-aged man. For six weeks he had suffered occasional attacks of sharp pains at the pit of the stomach, shooting thence into the left arm—attacks evidently of the nature of angina pectoris. He was well enough to follow his daily work, and to get about with little or no discomfort up to the day before his death. When first seen the indications pointed to a very weak heart. The pulse was extremely feeble and somewhat slow, but not irregular; hands cold and clammy; first sound of the heart absent; cardiac impulse against the walls of chest could not be felt; while the second sound of the heart could be only faintly heard, and several times was distinctly reduplicated. There were no murmurs of any kind. In the attempt to detect the cardiac impulse the patient winced, and complained of feeling sore at the part. On the following day he was dying. Sitting awkwardly upon the edge of a chair by the side of the bed supported by his wife, he gasped out, "I must keep as I am, I dare not stir." He had been in this uncomfortable position for ten or twelve hours. His face was pale and ghastly, large beads of sweat stood out on the forehead, while the extremities were clammy, pale, and cold. The pulse had failed: the breathing was shallow and gasping and attended with a rattle, of which the significance could not be mistaken. His mind was clear and collected; he complained of sickness; and said he knew that he was dying. At the autopsy, twenty-four hours after death, the heart was found dilated and flabby. The muscular structure of both ventricles, and in a lesser degree of both auricles, was soft and friable and almost black. It broke down readily under the finger like hepatized lung. As seen with the naked eye, it did not appear to be fatty, but there were considerable deposits of fat about the exterior of the heart. The pericardium, endocardium, and all the valves were quite healthy, and so also was the aorta. The left ventricle contained some loose and dark clots of semi-coagulated blood: in the right ventricle were some fibrinous but not decolorized clots adherent to the walls. Upon lifting up the heart by a portion of the right ventricle, the muscular structure broke down, and tore like wet paper by the weight of
the heart itself. Unfortunately no microscopic examination was made.

There seems to be some reason for believing that the muscles of the heart may occasionally be affected with rheumatic inflammation, causing sudden paralysis of the organ and death. This occurrence will possibly explain those cases of acute rheumatism, where patients have been suddenly seized with severe pain in the cardiac region, suffocative dyspnea, insensibility, convulsions, and death; and where afterwards no appearances have been detected on a careful examination of the body to account for the abrupt invasion of the fatal symptoms. It must not be overlooked, however, that possibly in some of these cases the fatal event may have been due to the formation of a coagulum in one of the large arteries.

IV. VALVULAR DISEASES OF THE HEART.

Affections of the valves, obstructing the onward course of the blood or permitting of its regurgitation, are the most common and the most important diseases of the heart, and are indeed generally indicated when heart-disease is spoken of without other qualification.

Causes and Effects of Valvular Disease.—Most of the alterations in the internal lining membrane of the heart result from inflammation, which gives rise to a deposit of lymph upon and beneath the serous membrane. The valves thus lose their beautiful thinness and transparency; they become thick and indurated, or puckered up, or adherent to each other or to the opposite walls of the channel, the chordae tendineae of the auriculo-ventricular valves being often thickened and shortened, or sometimes broken. The valves again may exhibit athroomatous or calcareous degeneration, sometimes in an extreme degree, or become covered with warty vegetations or excrescences, or they may be injured or lacerated, or they can be rendered inefficient by simple dilatation of the orifices which they guard.

The effects are twofold: either to contract and narrow the orifice and so obstruct the passage of the blood—valvular obstruction; or by puckering and shortening the valves, to render them incompetent to close the orifice, and hence permit of regurgitation of blood—valvular insufficiency, regurgitant disease of valves, &c. There may be only valvular obstruction or valvular insufficiency in any given case; but often these conditions coexist.

Diagnosis.—In the diagnosis of the diseases under consideration attention must be directed, firstly, to the physical signs; and secondly, to the chief functional symptoms.

The average frequency of respiration in health, in a state of
mental and bodily rest, is 18 in the minute, in the adult; taking
the pulse at somewhere between 72 and 80. This ratio is not only
easily disturbed by disease, but also by mental emotion and other
agents. To show the extent to which the pulse-respiration ratio is
altered in disease, cases of fatty degeneration of the heart may be
instanced. Thus, in this condition the ratio will often be as 1 : 2,
with such numbers as $\frac{1}{3}$ or $\frac{2}{9}$. In most forms of embarrassed
cardiac action the respirations are unduly frequent. The difficulty
of breathing varies from the slightest dyspnoea to the most severe
orthopnoea. Often it is the principal source of suffering; preventing
the sufferer from lying down, and giving rise to most restless
nights. In cases of heart disease where the victim is able to
pursue his ordinary avocations to a certain extent, any undue
exertion will often produce an attack of dyspnoea. This, however,
is seldom noisy, as it is when the bronchi or pneumogastrics are
pressed upon or irritated by an aortic aneurism.

The natural sounds of the heart are modified and changed,
causing either sound, or both, to be accompanied or to be
supplanted by a noise which has been aptly compared to
the blowing of a pair of bellow's; hence it is termed by us a
bellows-murmur, and by the French a bruit de soufflet. A bellow-
murmur may be harsh, or rough, or cooing, or whistling, or
musical; but these modifications are of little importance. For of
whatever nature, the important point to remember is, that this
bruit is caused either by the presence of obstructions or imperfecti-
ons (the consequence of disease or malformation) which on the
one hand impede or break the free current of blood through
the heart and its great vessels, or on the other permit of regurgi-
tation into a cavity from which it had been expelled—producing
an organic murmur; or else it is occasioned by a change in the
composition of the blood, or a clot in one of the heart's cavities—
giving rise to an inorganic, or functional, or hemie murmur. When
the valves of the heart are affected so that they act ineffectively,
an organic bellow's-murmur must result.

The arteries may also become the seat of murmurs. When the
calibre of a vessel is much increased so that the direction of the
blood-current is altered, or when the capacity is diminished so
that there is increased friction of the blood against the coats;
when the coats of the artery are diseased, with or without aneurism;
and when there is some direct communication between an artery
and a vein,—in all these cases an organic murmur results. A
functional or hemie murmur is due either to altered composition of
the blood, or to the formation of a clot in the vessel.

A murmur is frequently audible in the subclavian artery,
especially in men engaged in hard muscular work, caused by
pressure upon the vessel by neighbouring parts; it can usually be
produced or removed at pleasure by changing the position of the
shoulder. During the early stage of phthisis again a murmur
may sometimes be detected under the left clavicle, owing probably (as before mentioned) to the pressure of the tubercles upon the left subclavian artery; while not uncommonly a systolic bellows-sound is heard in the second left intercostal space over the pulmonary artery, the heart and the pulmonary artery being quite healthy. Moreover, displacement of the heart, owing to adherent pericardium, or to intra-thoracic tumours, or to the pressure of pleuritic effusion, ascites, &c., may give rise to a loud murmur, which does not disappear until the organ is restored to its natural position, by the removal of the fluid; though it must be confessed that a bruit under the latter circumstances is a rare event, for I have frequently looked in vain for it when the heart has been pushed considerably upwards by the presence of an ovarian tumour, or by pregnancy advanced to the full term.

The loudness and distinctness of organic cardiac murmurs are not proportionate to the extent of disease causing them, for sometimes an exceedingly small vegetation on one of the valves will produce a very loud murmur. Dr. C. J. B. Williams had a man, thirty years old, under his care, in whom there was a very loud murmur following the second sound; which murmur, though most distinct in the mid-sternum, was also heard in every part of the chest, in the arteries of the neck, and even slightly in the radial. The man caught typhus fever, from which he died; and at the post-mortem examination it was found that the valves were all healthy except the aortic, while in these the only change was that of one of them had the free margin neatly retroverted so as to leave a small smooth chink for regurgitation. The ventricles were also moderately enlarged and thickened.

The lining membrane, valves, and orifices of the left side of the heart are much more frequently diseased than those of the right. "Practically, in at least nineteen out of twenty cases," says Dr. Harvey, "the questions to be determined are, whether it be the mitral or the aortic value that is diseased, or both; and whether the disease be of the nature of valvular obstruction, or of valvular insufficiency, or both."* Diseases of the left side chiefly affect the arterial pulse, giving rise to irregularity and inequality; those of the right side affect the venous circulation, causing regurgitation into the jugular veins—a condition known as the venous pulse.* Dropsy is more often connected with disease of the right than of the left cavities.

The murmurs of purely acute endocarditis are thus arranged in order of frequency by Dr. Walshe:†—Aortic obstructive; mitral regurgitant; aortic regurgitant; aortic obstructive and mitral regurgitant together; aortic obstructive and regurgitant

* "Notes on Chronic Heart Disease." Association Medical Journal, p. 785. 1st September, 1854.
together. Pulmonary systolic and diastolic murmurs are infinitely rare. Dr. Walshe has never observed acute obstructive mitral murmur, nor acute regurgitant tricuspid murmur.

Disease of the semilunar valves of the aorta is not uncommon. Supposing that the affected valves diminish the aortic orifice during systole (or contraction) so as to prevent the blood from freely flowing out of the ventricle, a systolic bellows-murmur will result. This can be best heard at the base of the heart at the second right intercostal space close to the sternum, along the course of the thoracic aorta up towards the right clavicle, and even in the carotids; the murmur diminishing as the stethoscope is moved towards the apex of the heart. If the valves close imperfectly, permitting reflux of blood from the aorta, the murmur will be diastolic, will accompany the dilatation of the ventricle, and will be heard at the second right space and obliquely downwards and to the left along the course of the refluent blood, sometimes being heard very distinctly over the lower end of the sternum, sometimes more loudly in the direction of the apex. The short, second sound of the heart will also be muffled and indistinct, and will be inaudible in the neck. Sometimes we have both these conditions of the aortic valves in the same case—aortic obstruction and regurgitation together; a double bruit or bellows-murmur being then produced. The pulse of aortic disease is regular. In obstruction it is small and prolonged, giving a sphygmographic trace of small amplitude, sloping ascent, round top, and unbroken gradual fall. In the regurgitant form it is often peculiar, being generally sudden and sharp, and without any prolonged swell of the artery; Dr. Hope calls it a jerking pulse. It has also been called a collapsing pulse, from the sudden emptying of the vessel, and a hammering or even sledge-hammer pulse, from the forcible sensation communicated to the finger; while pulsation is usually distinctly visible in all the large arteries and in the radial at the wrist, becoming more conspicuous in the latter situation when the arm is raised, when also it is commonly audible. The sphygmographic traces of such a pulse are said to show certain peculiarities. There is a great amplitude of trace. The line of ascent is vertical. The curve usually presents a pointed summit. This vertical line of ascension and pointed summit are not peculiar, however, to aortic regurgitation; similar appearances being produced in functional disturbance from anaemia. But when the valvular incompetency is so great that there is free regurgitation, the descending line of the curve shows a sudden fall with an absence of diastole; the aortic notch being more or less suppressed, since the closure of the aortic valves which produces it is imperfect.

The mitral valve, which guards the left auriculo-ventricular orifice, may become thickened or ossified and its tendinous cords shortened; the effect of which is to prevent its closing the auricular...
orifice during the ventricular systole, so that regurgitation of blood from the ventricle into the auricle occurs; or the two divisions of the valve may be puckered and more or less adherent to each other, so as to hinder their lying flat against the walls of the ventricle and thus prevent the blood from passing freely into this cavity during the diastole. In some cases the orifice is reduced to a mere oval slit. A double orifice may perhaps be detected, but this is rare. The murmur or murmurs can be best distinguished towards the apex of the heart, on the left. When there is mitral regurgitation the murmur is systolic and of maximum intensity at or to the left of the apex, but it may be heard over a great part of the heart and can frequently be heard clearly behind — between the scapula and the spine, or at the lower angle of the left scapula. The pulse is irregular in frequency and force and usually soft and frequent. If the orifice is narrowed so as to cause obstruction to the flow of blood from the auricle into the ventricle, the murmur, if one is present, which is not always the case, is presystolic, as it is heard towards the end of the diastolic interval at the moment when the auricle contracts to complete the distension of the ventricle, and leads up to the first sound. It is usually most distinctly audible rather to the inner side of the apex, and is often accompanied by a thrill felt on palpation. This murmur is sometimes difficult of identification and is liable to be considered systolic in consequence of the first sound becoming short and sharp so as to be taken for the second. A careful comparison of the time of the murmur with that of the apex beat or of the pulsation in the carotids, which it will be found to precede, will, however, enable the distinction to be made out; or the stethoscope may be first placed over the base of the heart, where the two sounds will be heard, then on carrying it little by little towards the apex, the second sound will disappear and the murmur will be found to run up to the first. Palpation also often discovers a purring thrill. Mitral disease, whether obstructive or regurgitant, interferes with the pulmonary circulation; all the vessels concerned in which get enlarged, the lungs are constantly overcharged with blood, as the circulation through them is sluggish, and hence there is lividity with a tendency to hemorrhage into the air-sacs. The right ventricle becomes hypertrophied and ultimately dilated; and sooner or later there will be a condition of stasis in the systemic veins, persistent congestion of the liver and often of the kidneys, with jaundice and dropsy and albuminuria.

The semilunar valves of the pulmonary artery are very rarely diseased; so rarely that any organic alteration in them is a pathological curiosity. When, however, a bellows-murmur can be traced from the middle of the left edge of the sternum up towards the left clavicle, and when this murmur cannot be heard in the subclavian or carotid arteries, we may assume that it originates at the orifice of the pulmonary artery. The pulse remains unaltered.
The tricuspid valve, guarding the right auriculo-ventricular opening, is also but seldom found otherwise than healthy. When diseased, the morbid condition will almost invariably exist in combination with aortic or mitral affection, or with both. In dilatation of the right ventricle from mitral incompetency there may be tricuspid regurgitation without change of structure, but more commonly the long continued strain on this valve will have given rise to chronic inflammation with thickening and contraction. In such cases there may or may not be tricuspid murmur, which when present will be loudest at and near the ensiform cartilage, occurring with that of mitral obstruction or regurgitation. Turgescence, with pulsation of the jugular veins at every ventricular systole, is present in those cases of tricuspid disease dependent on dilated right heart.

To determine the systolic, diastolic, or presystolic character of a murmur, the apex beat or the pulse, in the carotids should be carefully noted during auscultation: if systolic, the bruit must of course be synchronous with these. The radial pulse must not be trusted to, since a variable, and sometimes considerable time is lost between the heart and vessels at this distance from it.

Inorganic or functional murmurs generally counterfeit aortic or pulmonic bruits as regards their position. A murmur which is best heard over the base of the heart and the great arteries, which is single and systolic, which is accompanied by an anaemic murmur in the neck, which varies in intensity under different states of the system, and which is not attended by a turgid condition of the vessels,—such may be set down as a functional bruit.

Following the plan of Dr. Harvey, the signs of disease of the valves may be thus briefly tabulated:

**Bruit**:—If systolic, and loudest at
   - **Base**—at right 2nd space and upwards towards neck = Aortic obstruction.
   - **Base**—at left 3rd space and upwards towards middle of clavicle = Pulmonary obstruction generally hermio.
   - **Apex** = Mitral insufficiency or regurgitation.
   - Ensiform Cartilage = Tricuspid insufficiency.

**Bruit**:—If diastolic and loudest at
   - **Base**—right 2nd space and obliquely downward = Aortic insufficiency.
   - **Apex** = Mitral obstruction.

**Pulse**: If regular,
   - Small and long, = Aortic obstruction.
   - Full, jerking, collapsing, = regurgitation.
   - Soft, small, weak, = Mitral obstruction.

**Pulse**: If irregular,
   - Weak, intermittent, unequal, = regurgitation.
It is only in aortic and mitral regurgitation that the pulse is strikingly characteristic.

The structural and functional changes caused by valvular disease will be the following. In aortic obstruction the additional force required for the propulsion of the blood through a narrowed orifice leads to hypertrophy of the left ventricle, which, except in extreme cases, may compensate for the obstruction; but should the heart be overtaxed, there may be fatal syncope, which is however rare. In aortic regurgitation there is dilatation and hypertrophy of the left ventricle caused by the distension of this cavity by the refluxed blood. It is in these cases that the heart attains its maximum size and merits the name cor bovinum. The dilatation as well as the hypertrophy is compensatory, since a larger quantity of blood is expelled from the more capacious ventricles, a part of which returns; but as the supply of blood to the heart itself through the coronary arteries is maintained by the aortic recoil, the force of which is wasted by regurgitation of blood into the ventricle, the heart is liable ultimately to be imperfectly nourished, and thus to undergo degeneration, so that the compensation is not sustained. In both obstruction and regurgitation a considerable degree of valvular change will necessitate a considerable amount of hypertrophy, and vice versa, so that the extent of hypertrophy becomes in some measure an indication of the valvular lesion, which a murmur is not. But in aortic disease of whatever kind additional stress is thrown on the mitral valve, and this may give way or become inflamed, thickened, or puckered in consequence of strain, and mitral regurgitation be superadded. Mitral regurgitation, however, is more commonly the result of primary changes in this valve, as is also obstruction. The effect of either obstruction or regurgitation here is to hinder the exit of blood from the lungs, which will lead to pulmonary congestion and its consequences. Greater force, moreover, will be required to carry the blood through the lungs, and thus the right ventricle becomes hypertrophied, the degree of which hypertrophy again becomes a measure, though very indefinite, of the pulmonary obstruction caused by the valvular lesion on the left side of the heart. There will also be hypertrophy of the left ventricle in mitral regurgitation and of the left auricle in mitral obstruction. It is from hypertrophy of the right ventricle and disease of the mitral valve primary or secondary that pulmonary apoplexy usually arises. As the right heart becomes unequal to the perfect transmission of blood through the lungs, there is systemic venous obstruction, congestion, and retarded circulation through the liver, kidneys, alimentary canal, &c., resulting in proliferation of the connective-tissue elements, and fibroid condensation, and eventually in dropsy, especially if the tricuspid valve becomes insufficient through stretching of the orifice or inflammatory changes set up by undue strain.
The symptoms to which valvular disease of the heart gives rise are chiefly those of derangement of the pulmonary and systemic circulation. Sometimes there is palpitation of the heart perceptible to the patient, and attended with a feeling of oppression, or anxiety, or a sense of breathlessness, but this is not common, and when it occurs is usually an early and fugitive symptom before the establishment of compensatory changes. Shortness of breath on exertion, especially on going up hill or against the wind, is a very common symptom. Cephalgia, tinnitus aurium, vertigo, and syncope are occasionally complained of, particularly in aortic disease, where the compensation is inadequate, or when it begins to fail from degeneration of the ventricular walls. The most characteristic symptoms are those arising from obstruction to the pulmonary circulation, cough, and shortness of breath, gradually aggravated to extreme dyspnoea, attacks of congestion or oedema of the lungs, hemoptysis, pulmonary apoplexy, pneumonia, effusion into the pleural cavity, the countenance flushed and dusky, the face puffed, the lips of a dark red hue, and the eyes bright. As the right heart becomes unequal to overcome the obstruction to the pulmonary circulation systemic venous stasis comes on, the liver and spleen become enlarged, the urine may be albuminous from renal congestion, haemorrhage from the gastrointestinal mucous membrane may occur, and dropsey eventually supervenes—sometimes early; sometimes late. These effects are most common in mitral disease, and especially when tricuspid regurgitation has been superinduced. As the various symptoms are developed the patient gets weak, nervous, and irritable: with the increased pulmonary embarrassment the rest becomes broken; if the patient falls asleep he wakes with a start, gasping for breath, and has horrible dreams. He will be unable to lie down, and while worn out for want of sleep, scarcely dares to close his eyes. The most common mode of death is by combined exhaustion and apnoea, but sometimes life is cut short by syncope or by cerebral haemorrhage.

The prognosis has to be considered under two sets of circumstances:—When valvular disease is known to exist, but no urgent symptoms are present, and again, when such symptoms have arisen. There will be less probability of prolonged and comfortable life when more than one valve is affected. The common individual valvular lesions may be placed in the following order as regards danger:—Mitral obstruction, aortic regurgitation, mitral regurgitation, aortic obstruction; but many exceptions to this rule will be met with. A more important matter is the extent to which the function of the valve is impaired, the degree of obstruction, or the amount of regurgitation produced. The murmurs give no clue to this, but an indication is afforded by the amount of hypertrophy and dilatation which have been developed, and the perfect or imperfect character of the resulting compensation. If the enlarge-
ment of the heart is not great, and the pulse continues regular and
good while breathlessness is not very readily induced, the loudest
murmur may be disregarded, while if the hypertrophy is consider-
able, however free from inconveniences the patient may be, the
prognosis is doubtful, since a large compensation implies a serious
lesion, and a slight circumstance—cold, or over-exertion—may
disturb the balance irretrievably. Undue loudness of the pulmonary
second sound as heard at the third left space is indicative of
pressure in the pulmonary circulation, and implies a liability
to lung complications. Tricuspid regurgitation is always of serious
import, as are also evidences of failing circulation from dege-
neration of the heart-walls.

A question of great moment is whether the valvular change
is stationary as after a long past attack of acute rheumatism, or
progressive, as it is liable to be late in life, and whether or not the
patient is compelled to perform laborious work. When complica-
tions, pulmonary congestion, apoplectic pneumonia, dropsy, have
set in, their extent and severity will constitute the primary prog-
nostic indications, but the considerations given above are often
valuable, and may give hope in most serious cases. Much depends
on the circumstances under which the symptoms have come on: if
they have appeared gradually under conditions favourable to health,
and without obvious exciting cause, so as to be clearly due to the
development of the effects of the valvular change, there is little or
no hope of amelioration; whereas if they are traceable to cold,
over-work, or other cause, recovery may often be expected.

Treatment.—In the treatment of the valvular diseases of the
heart three indications have generally to be followed:—(1) To
invigorate the walls of the heart, and to abate its inordinate
action by tonics and sedatives—as digitalis, belladonna, the
American wild cherry, hydrocyanic acid, aconite, conium, hen-
bane, hop, and morphia; though these remedies, and especially
the last, must be employed with great caution, for where there is
a feeble pulse, dyspnea, and difficult expectoration, a dose of
opium may but materially hasten death. The most valuable
of these agents is undoubtedly digitalis, which has been shown to
render the heart's action less frequent and more powerful, while
at the same time it causes contraction of the minute arteries and
thus raises the blood-pressure. The diminished frequency allows
the heart more rest, and the increased intra-vascular pressure
drives more blood into the coronary arteries, so that the nutrition
of the organ is improved. (2) To ward off or gradually relieve
the results of the cardiac disease,—such as pulmonary congestion,
pneumonia, hemorrhage, congestion of the liver and kidneys,
dropsy, &c. This is to be attempted by ordering a nutritious
diet, and by maintaining the various secreting organs in a
healthy state; saline purgatives and diuretics, repeated at proper
intervals, being very valuable. When the dropsical effusion is
great, much benefit may often be derived from mercury; diuretics, which had previously been useless, often causing an astonishing flow of urine directly the gums get touched. The latter effect, however, is frequently obtained with difficulty where the obstruction to the circulation is great. In anasarca of the lower extremities, small incisions in the legs, or the insertion of a small cannula beneath the skin, or deep punctures on the outer side of the dorsum of the foot give great relief, by allowing the serum to drain off; the chilly and moist uncomfortable feelings caused by the flow of fluid being best mitigated by wrapping the limbs in soft chamois leather, while the skin is protected from irritation by the fluid by smearing it with zinc ointment. (3) We must endeavour to give strength and tone to the heart, so as to assist it to do its work. There will be most hope of accomplishing this by nourishing food, perhaps cod liver oil; a duly regulated supply of stimulants, pure air, warm clothing, early hours, gentle exercise, cold or tepid salt-water sponge baths, avoidance of all bodily and mental excitement, and by the administration of tonics—especially one of the various preparations of steel.

V. HYPERTROPHY OF THE HEART.

The heart is stated roughly to be about the same size as the closed fist. The average weight of this organ in the adult male may be said to be nine and a half ounces, that of the female being eight and a half.* After the age of sixty the heart is somewhat heavier, since the thickness of the walls of the left ventricle has then become decidedly increased. The muscular parietes of one or more of the cavities may become thickened without any diminution in the size of the chamber: this is called simple hypertrophy. Or, as most frequently happens, the walls will be thickened and the chamber become larger than natural: this is eccentric hypertrophy, or hypertrophy with dilatation. On the other hand, the increase in thickness may be accompanied with diminution in the size of the cavity: a condition known as concentric hypertrophy. This last form, if not simply the result of contraction or rigor mortis, is now believed only to occur as a congenital malformation, and never as the consequence of disease. The cause of the hypertrophy is usually some obstruction either to the flow of blood through the heart, or to the circulation of the blood through the arteries, arterioles, or capillaries, or to inter-

* The weight of the healthy heart in persons from twenty to fifty-five years of age averages, in males 9 oz. 8 dr., and in females 8 oz. 13 dr. Estimates of this description are of course, to a certain extent, arbitrary.—Dr. Peacock: Monthly Journal of Medical Science, vol. xix. p. 211. Edinburgh, 1854.
ference with the free play of the heart, whence the amplification is frequently a compensatory provision to counterbalance the impediment. The heart is stimulated to extra exertion; and in consequence it receives an extra supply of nutritive materials, by which its muscular structure is strengthened. The left ventricle is more frequently found hypertrophied than the right, and much more so than the auricles. In a heart which weighed five pounds, the walls of the left ventricle had acquired a thickness of two inches. It is not certainly known whether the increase in bulk is due to increase in size of existing muscular fibres or to the production of new fibres.

The sources of obstruction of blood through the heart will be the different valvular diseases. Aortic obstruction usually gives rise to simple hypertrophy of the left ventricle; aortic regurgitation to hypertrophy with dilatation. It is in this condition that the size of the heart attains its extreme development. Mitral regurgitation is usually attended with some degree of hypertrophy of the left ventricle, but the reflux of blood into the pulmonary veins and the consequent obstruction in the pulmonary circulation throw increased work on the right ventricle, which becomes greatly hypertrophied. Mitral obstruction gives rise to hypertrophy of the left auricle and right ventricle. Obstruction to the circulation through the systemic arteries, and consequent hypertrophy of the left ventricle, may arise from senile arterial degeneration, but more frequently from chronic Bright's disease. In the latter case the circulation of the blood rendered impure by urinary constituents is resisted by the capillaries and by the contraction of the minute arterioles, the muscular coat of which, as Dr. George Johnson has shown, becomes hypertrophied. Obstruction to the pulmonic circulation giving rise to hypertrophy of the right ventricle, not due to mitral disease, occurs in emphysema, chronic bronchitis, and other chronic diseases of the lungs. Other causes of hypertrophy are adherent pericardium, long-continued excessive muscular exertion, dilatation from pericarditis or other cause, subsequently compensated by increase of the muscular wall. Occasionally this condition is found when no cause can be assigned, and sometimes a spurious hypertrophy occurs in which the increased thickness of the ventricular walls is due to connective tissue, and not muscular fibres.

Physical Signs.—These are increase in the area of cardiac dulness with displacement of the apex downwards when it is the left ventricle which is enlarged, to the left when it is the right ventricle. The impulse is heaving and powerful, and when the right ventricle is hypertrophied it is felt and seen between the left nipple and the sternum. If no murmurs are present the first sound will be more prolonged and less sharp, the second louder than normal.

Symptoms.—Hypertrophy being generally compensatory of some antecedent mischief, it is difficult to assign to this condition
its share of disturbances occurring when it is present; there may be palpitation, dyspnoea, difficulty of walking quickly, uneasiness and pain in the cardiac region, headache and attacks of vertigo. Among the more serious effects of hypertrophy of the left ventricle is cerebral haemorrhage, which is especially liable to occur when it is due to right's disease. Epistaxis is a less formidable consequence. Hypertrophy of the right ventricle may cause pulmonary apoplexy and hæmoptysis.

As the hypertrophy in these cases is an endeavour (so to speak) towards health, the increased power compensating for the obstruction to the flow of blood caused by the valvular diseases, we must not unnecessarily interfere with the symptoms.

The treatment must consist in keeping the patient as free from undue excitement as possible, and in prescribing for his symptoms. If there be much debility, quinine or steel or both (F. 389, 394, 405), bark (F. 371, 376), or the mineral acids (F. 377, 378) had better be given; if the heart's impulse be very great, acridine (F. 330), or digitalis (F. 334), or the American wild cherry (F. 333), can be occasionally but cautiously tried; while when the dyspnoea is urgent, stimulants, especially ammonia and spirit of ether (F. 361, 367), may be had recourse to. The chief point to be kept in view is this,—that while the effects of the hypertrophy on the circulation are frequently favourable, yet too great force might possibly lead to pulmonary (or even to cerebral) apoplexy.

Dilatation of the Heart.—This may occur under three circumstances. First, there may be, as has been just shown, hypertrophy with dilatation; such a condition being known as active dilatation, when the expansion predominates over the hypertrophy. Secondly, we have simple dilatation, where the thickness of the walls is normal. And thirdly, there is passive or attenuated dilatation, the walls being thinned. This last is the only state which demands a few words.

Passive dilatation is often combined with malnutrition of the heart, and fatty degeneration of the muscular fibres; both ventricles are usually affected, though the right may be so in a more marked degree than the left; and the attenuation will perhaps be so extreme that the walls are found quite collapsed after death. Passive dilatation may be due to some exhausting disease, or to inflammation of the endocardium, or perhaps to pericardial adhesion. The chief symptoms are a small, weak, and perhaps irregular pulse; coldness and slight lividity of the extremities; with giddiness, and derangement of the digestive organs. There is a tendency to congestion of the liver, to imperfect action of the kidneys, and also to congestion of the lungs. Moreover, the patient is restless at night, gets weak and irritable, and suffers from asthmatic paroxysms (cardiac asthma): palpitation is often distressing, attacks of syncope are not uncommon, and there is anasarca followed by ascites. The physical signs are,—increased
præcordial dulness, undue distinctness of the heart's sounds, the first being unduly short and sharp, sometimes irregular action of the heart, sometimes reduplication of the sounds, and generally almost imperceptible cardiac impulse. There will be no murmur if the valves remain healthy; unless the dilatation of the ventricles be so great, that valvular incompetency is necessarily caused by the orifices becoming enlarged. Antispasmodics, ferruginous tonics, and agents to promote the digestion of nourishing food, are the only remedies which afford temporary relief in this serious disease.

VI. ATROPHY OF THE HEART.

There are two forms of atrophy of the heart. One, in which the organ simply wastes and dwindle in all its parts; the other, in which the texture of the muscle suffers a sort of conversion into fat—becomes affected with fatty degeneration.

Simple atrophy occurs in connexion with many exhausting diseases,—to wit cancer, tuberculosis, diabetes, &c. The whole organ diminishes in size; so that after death it may be found to weigh about five ounces instead of nine. Minutely examined, the muscular fibres are detected pale and soft, but otherwise healthy. The treatment must be that which is demanded by the constitutional affection, of which the atrophy is merely one symptom.

Fatty degeneration of the heart is a most interesting disease, which has been already incidentally noticed. The student who wishes to study the subject thoroughly may be especially referred to the writings of Dr. Richard Quain, Dr. Ormerod, Sir James Paget, Mr. Barlow, Dr. Wilks, and Prof. Virchow.

This disease occurs under two circumstances; either alone, or in conjunction with fatty disease of other organs, as the kidneys, liver, cornea, &c. Its diagnosis is beset with difficulties; so that when existing alone its presence is every now and then unsuspected until after death, and after a microscopie examination of some of the muscular fibres of the heart. Valvular disease very rarely coexists; but where it does, the aortic valves appear to be more generally affected than the mitral. There is no connexion between this process of decay, and the accumulation of adipose tissue around the heart. The most prominent symptoms of fatty degeneration are a feeble action of the heart, a remarkably slow pulse—sometimes as low as fifty or forty-five or even thirty-five in a minute, general debility, transient attacks of giddiness or faintness, a tendency to sigh frequently, a palpit and flabby appearance, a feeling of nervous exhaustion, and a marked loss of tone, &c. Both sounds of the heart are weak, the first being especially faint; while the impulse of the apex against the chest-walls is feeble or even imperceptible. In advanced cases there are attacks of dyspnœa, produced by
even moderate exertion; together with many or all of the symptoms which prevail in angina pectoris. When in addition there is a well-marked arcus senilis (due, as Mr. Canton has shown, to fatty degeneration of the edge of the cornea) the diagnosis may perhaps be facilitated; though I have long been convinced that in many cases of arcus senilis the heart is quite healthy, while the latter is often affected with fatty degeneration without the arcus being present.

Fatty degeneration of the heart seems to occur rather more frequently in men than in women: it may take place at all ages, though it happens principally at advanced periods of life; all classes of society may suffer from it. Moreover, it either exists singly, or with other cardiac diseases; and it is not uncommonly a cause of sudden death. "On opening a heart thus affected," says Dr. Ormerod, "the interior of the ventricles appears to be mottled over with buff-coloured spots of a singular zigzag form. The same may be noticed beneath the pericardium also; and in extreme cases the same appearance is found, on section, to pervade the whole thickness of the walls of the ventricle and of the carneae columnae." On microscopically examining these spots, their nature is revealed; they are not deposits, but degenerated muscular fibres. Instead of seeing transverse striae and nuclei—the evidence of a healthy state—little can be distinguished but a congeries of oil-globules. The muscular fibres are also found to be short and brittle; and Dr. Quain has pointed out that the coronary arteries are often obstructed. Sir James Paget well remarks that "the principal character which all these cases seem to present is, that they who labour under this disease are fit enough for all the ordinary events of calm and quiet life, but are wholly unable to resist the storm of a sickness, an accident, or an operation."—From the foregoing it will appear that the prognosis must always be unfavourable. Dilatation, rupture, and aneurism of the heart are the prominent changes most frequently found in connexion with this affection.

Sometimes the fat which is normally deposited upon the heart is increased on and amongst the muscular fibres to a morbid extent; and we then speak of the condition which results as fatty growth. This may happen alone, or in conjunction with general obesity; or it will be associated with fatty degeneration. It is possible that the arcus senilis much more frequently accompanies these cases of fatty growth, than those of fatty degeneration. The symptoms of fatty growth, when it exists alone, are those of a heart enlarged and impeded in the performance of its functions. The pulse is permanently quickened above the normal standard, while its force is diminished.

In the present state of our knowledge, the treatment of a case of suspected fatty disease of the heart resolves itself chiefly into preventing further degeneration of tissue. The means to adopt therefore are—nourishing animal food, attention to the digestive
organs, pure air, early hours, gentle exercise, and the use of bark or very mild ferruginous tonics. Soda water will prove useful as a drink; a little brandy or sherry may be given with it. The patient should daily take a salt-water sponging bath. Everything which can hurry the circulation ought to be avoided; while agents which weaken the power of the heart, such as tobacco, invariably prove mischievous.

Some authors object to the use of fat meats, of milk, and indeed of all oleaginous foods. But it is difficult to understand the ground on which these restrictions are recommended; since the disease is a degeneration of tissue, caused by debility or a wearing-out of the frame, rather than by an excess of power. Hence I believe that cod liver oil, cream and milk, may generally be given with great advantage.

These remarks are not meant to apply to the treatment of fatty growth with general obesity. In such cases the patient should be dictated according to the directions already given.

A brown degeneration of the heart is described, but it is rare, and is not characterized by any special symptoms during life.

VII. CYANOSIS.

Cyanosis [Κυανός = blue + νόσος = disease], morbus caeruleus, or blue disease, are terms applied to a condition characterized by a blue or purplish discoloration of the skin; arising generally in connexion with some deficiency in the construction of the heart.

The chief malformations are the following:—A permanence of the foramen ovale, allowing the passage of the blood between the two auricles; abnormal apertures in some part of the septum of the auricles or of the ventricles; the origin of the aorta and pulmonary artery from a single ventricle; a transposition of the origins of the large vessels from the heart, the aorta arising from the right and the pulmonary artery from the left ventricle; an extreme contraction of the pulmonary artery; or, lastly, the continued patency of the ductus arteriosus, permitting a mixture of the bloods of the aorta and the pulmonary artery.

Three explanations have been given as to the immediate cause of the discoloration of the surface in these cases of malformation. Thus, some pathologists refer it solely to general venous congestion; others regard the intermixture of the two currents of blood as the cause; while a third class believes that it is partly due to congestion of the venous system, and partly to the intermingling of the venous with the arterial blood. The truth is probably this: that the discoloration is owing to systemic venous congestion, but that it may be aggravated by certain malformations. On the other hypothesis it seems impossible to explain the admitted facts, that malformations permitting the free admixture of arterial and venous
blood may exist without giving rise to cyanosis; while the latter is sometimes found where no such admixture could have taken place. The cause of the general venous congestion is some obstruction to the flow of blood through the lungs, or from or into the right ventricle; such obstruction frequently consisting in a contraction of the pulmonary artery or its orifice.

In addition to the discoloration of the skin, the patients who survive their birth suffer from coldness of the body (sometimes the temperature, as marked by the thermometer in the mouth, has been as low as 77° Fahr.), palpitation, fits of dyspnœa, syncope on the least excitement, &c. The tips of the fingers, and sometimes of the toes, become bulbous after a time, and the nails are often incurvated. The generative organs are frequently imperfectly formed—there is evidence of early arrest of development. Bronchial haemorrhage and bronchorrhœa seem to have occurred in many instances. Moreover, in cases about to terminate fatally we have congestion of internal organs, and tropial effusions. The cutaneous discoloration is generally increased by aught which excites the circulation. With some few cases the symptoms of cyanosis are not manifested until many months after birth. Infants affected with the disease generally die at a very early age; but occasionally, they live on even to the adult period. Males are notably more prone to cyanosis than females: a satisfactory explanation of this fact remains to be discovered.

The physical signs are diversified, just as the malformations are multifarious. Whatever the defect may be, however, there is frequently hypertrophy with dilatation of the right ventricle. Murmurs will of course be detected if there be valvular incompetency, or constriction of the orifices.

Under exceptional circumstances cyanosis may not come on until somewhat late in life. Cases like the following are related:—

A lady, aged 38, under the care of Dr. Theophilus Thompson, was always well until she had an attack of cholera, which impaired her health: two years prior to her death she suffered from fever, and from this time was cyanotic.—Bouillaud quotes an instance, where cyanosis followed a difficult labour at the age of twenty-six.—Dr. Harrison has recorded the case of a baker, who became cyanotic at 15, after using great exertion in carrying wood.—Dr. Speer has published the history of a girl, thirteen years old, who had to fill a situation needing great exertion, and she was thenceforth cyanotic.—Dr. Reisch of Vienna has given an account of a woman, 49 years old, who always had good health until an attack of rheumatic fever with endo-pericarditis, after which cyanosis and dropsy set in. Auscultation detected a loud systolic bruit, which had its maximum intensity at the apex of the heart; the second sound being weak and indistinct. There was intense cyanosis of the face; with considerable swelling of the jugular veins, and evident regurgitation in them. At the autopsy, in addition to other morbid
appearances, the valve of the foramen ovale was found imperfect, there being a crescentic opening which admitted the first joint of the little finger.

The treatment should be simply palliative, the organic cause being irremediable. A very nourishing diet, warm clothing, the avoidance of fatigue or undue mental excitement, and residence in a pure mild air, will give the sufferers from cyanosis every chance of life which can be afforded them.

VIII. RUPTURE OF THE HEART.

Rupture of the heart may occur spontaneously from previous disease, or it may be caused by external violence. Rupture from disease is much more frequent on the left than on the right side of the organ; whereas when it occurs from external violence we find just the reverse. The laceration most commonly has its seat in the ventricles, and in that of the left side when disease is its source. Out of fifty-two cases collected by Gluge, the left ventricle was the seat of the lesion in thirty-seven, the right ventricle in eight, the left auricle in three, and the right auricle in two cases. Rupture of the valves or their tendons is generally the consequence of a prior attack of endocarditis; whereas laceration of the muscular wall of the heart most frequently is symptomatic of fatty degeneration. Probably there are six ruptures from fatty degeneration, to one from any other cause. Laceration may also be due to an aneurism in the ventricular wall; to malignant degeneration; and perhaps hydatids, by causing atrophy of the muscular fibres, might lead to it. The rupture takes place as frequently at the apex as at the base. The immediate cause is usually some sudden strain or emotion. This accident happens more frequently in males than females; while its occurrence is rare until after the fiftieth or sixtieth year.

I have seen a case of sudden death from ulceration of the wall of the left ventricle ending in rupture, where there had been no previous symptoms of heart disease. And yet the ulcer was nearly if not quite the size of a florin; was in my opinion of a cancerous nature; and had fairly eaten its way through the tissues, the rent being one inch in length. The gentleman who was the subject of this disease was 68 years old. He had gone to bed apparently quite well; must have got up in the night; and was found dead in his chair the next morning. There could scarcely have been any suffering, for his features were calm; while a book he had been reading remained open on his lap.

Supposing that death is not the immediate result of this accident, the symptoms which indicate the occurrence of rupture are great orthopnoea, intense prostration, syncope, and convulsions.
In laceration of the valves, of the chordae tendineae, or of the muscular papillares, there is sudden great oppression about the præcordia, together with a loud endocardial bruit.

As regards the majority of cases, rupture of the heart kills instantaneously; not so much, however, as a rule, by the loss of blood, as by the embarrassment to the play of the heart or lungs which arises from the extravasation. In more than one instance, however, the patient has been known to survive some hours, or even days; the wound having become plugged by coagula, so that the extravasation of blood into the pericardium has taken place slowly and gradually.

IX. ANGINA PECTORIS.

This is a paroxysm al disease, first described by Dr. Heberden in 1768, who called it a disorders of the breast ; remarking that "the seat of it and the sense of strangling and anxiety with which it is attended, may make it not improperly be called angina pectoris." It is not of very frequent occurrence.

The symptoms of "suffocative breast-pang" consist of paroxysms of intense pain about the præcordial region, accompanied with a feeling of suffocation and a fearful sense of impending death. The pain in the breast is variously described by sufferers as lancinating, burning, or constrictive; and it often seems to radiate from the centre of the sternum to the neck, or to the back, or to the left shoulder and arm. If the paroxysm come on while the patient is walking, immediate rest is necessary; the anguish being most extreme for the time. During the attack the pulse is small and slow, the breathing short and hurried, the countenance pale and anxious, the surface of the body cold and perhaps covered with a clammy sweat, while the consciousness is unimpaired. As the struggle passes off, the patient regains his usual health, and perhaps appears perfectly well.

The duration of the seizure rarely exceeds two or three minutes; though it may last for half an hour, or an hour, or even longer. The attacks are at first brought on by exertion and occur at uncertain intervals of weeks or months; but in confirmed cases the periods of recurrence approximate more and more with each successive paroxysm, while the seizure may come on at any time: not only when the patient is walking, but even when in bed. The pain is most severe, and is attended with a feeling as if life were about to cease; the paroxysm may indeed at once prove fatal.

It necessarily follows from the foregoing, that the prognosis is unfavourable to a marked degree; for if death do not ensue in an early seizure, it generally does so in some subsequent attack. The disease occurs most frequently in advanced life, and is much more
common in men than in women. In some few instances it has seemed to have an obscure connexion with gout; and I have read of gout and angina pectoris alternating with each other in the same individual. But I apprehend this only happens in gouty subjects who have a weakened heart, either from attenuation or from fatty degeneration.

With regard to the pathology of angina pectoris, it may be said that our improved means of observation have rendered it almost certain that this most distressing disorder is always associated with some important organic cardiac affection; although, in all probability, it is not connected with one form of heart disease only. In many instances fatty degeneration of the muscular fibres of the heart has been detected; a condition which, occasionally at least, seems to be connected with partial obstruction of the coronary arteries. Sometimes possibly, atheromatous deposit, or a syphiloma about the root of the aorta and aortic valves, will be found to have obstructed the coronary arteries by encroaching upon their openings. In the attack, however, there is apparently general arterial spasm which causes resistance to the circulation and throws stress upon the enfeebled heart.

Sir John Forbes, in an essay published in 1833, before the value of the microscope was appreciated, collected the histories of forty-five examples of angina pectoris, in which the body had been examined after death. In two of the cases there was disease of the liver only; in four, there was nothing morbid except an excessive coating of fat about the heart; while in the remaining thirty-nine there was found organic disease of the heart or great vessels. Of these latter cases, in ten there was organic disease of the heart alone; in three of the aorta alone; in one of the coronary arteries alone. But there was ossification, or cartilaginous thickening of the coronary arteries, combined with other disease, in sixteen instances; and there was a morbid condition of the cardiac valves in sixteen cases likewise. The aorta was diseased in twenty-four cases, and in twelve there was preternatural softness of the heart.

The treatment during a paroxysm consists in the administration of stimulants, such as ammonia, wine, and brandy; and of antispasmodics,—as ether, opium, chloroform, hydrocyanic acid, &c. I have found a mixture of ammonia, spirit of chloroform and of ether, a little belladonna, and tincture of cantharides (F. 85), exceedingly valuable in giving speedy relief. The patient should always carry a dose of this medicine about with him, in order that it may be taken on the least-threatening of an attack. A remedy which has proved most effectual, however, is the nitrite of amyl, first tried by Dr. Lauder Brunton; the inhalation of a few drops relaxes the arterial spasm and relieves the over-strained heart. Simpkins, turpentine stupes, hot fomentations, and liniments containing belladonna and chloroform will help to relieve the suffering.

The return of the seizure is to be guarded against by improving
the general health; by constant attention to diet; by the occasional use of well-selected tonics; and by the avoidance of stimulants, strong exercise, walking soon after meals, and all mental excitement. A belladonna plaster worn constantly over the precordial region may do good.

X. CARDIAC ANEURISM.

Aneurism of the heart was formerly said to occur in two forms:—either as a simple dilatation of the wall of a ventricle, forming the improperly called passive aneurism of Corvisart; or as a pouched fulness arising abruptly from the ventricle, constituting a tumour on the heart’s surface. The latter is the only disease to which the designation of cardiac aneurism (or partial dilatation) should be applied. In it the tumour may vary in size from that of a small filbert to a growth as large as the fist; the sac is found to contain layers of fibrin or laminated coagula of blood, especially when its mouth is constricted, like arterial aneurisms; while it generally has its seat in the left ventricle, much more rarely in the left or right auricle, but never in the right ventricle.

According to Rokitansky there are two distinct kinds of cardiac aneurism. The first or acute variety depends upon a laceration or ulceration of the endocardium, through which the blood passes, displacing and destroying the muscular fibres, and gradually making a pouch; while in this pouch fibrin is deposited, its entrance presenting a fringed margin of endocardium with vegetations attached. The second or chronic form is the result of some inflammatory condition of the muscular fibre, or of the investing or lining membrane of the heart. The walls of the sac consist of the endocardial and pericardial membranes unbroken, while the muscular fibre seems to be replaced by a fibroid tissue. Either kind gives rise to symptoms which are uncertain and obscure. Often the passage of the blood into the sac has caused a murmur, but this has been mistaken and thought to be due to some valvular lesion. Death may occur in consequence of the supravention of extraneous disease unconnected with the aneurism, or from impairment of the heart’s action; or it will happen suddenly from the wall of the latter giving way, the blood being poured into the pericardium, or into the pleura—if the free surfaces of the pericardium be adherent, as they often are in these cases.

The coronary arteries are now and then diseased. Fatty degeneration and ossification of their coats, obstruction of their canals, and small aneurismatic dilatations of their walls are not frequent events. There may be only one aneurism; or several branches of both the right and left coronary artery, or one or both main trunks will...
perhaps be found dilated into a set of sacculated little tumours. With this condition, all the other vessels in the body need not necessarily be otherwise than healthy. In the instances which have been recorded there have been no symptoms during life to allow of a correct diagnosis, or sometimes even of a suspicion of heart disease; while death has occurred gradually from a progressive loss of strength and exhaustion, or suddenly from rupture of the aneurism—the pericardium being afterwards found filled with blood or in a paroxysm of angina pectoris.

XI. TUMOURS OF THE HEART.

Morbid growths of a benignant or malignant character in the interior of the heart are of rare occurrence, and consequently very little is known of the clinical history of these cases. Syphilitic and cancerous tumours have been known to give rise to sudden death without previous indications of their presence. In other cases the chief features which have been noticed seem to have consisted of progressive weakness, with paroxysms of dyspnœa; the latter gradually increasing, until the breathing has become permanently laborious and panting. With this breathlessness, there has been an incessant dry cough; as well as a frequent small pulse, an occasional paroxysm of substernal pain, disturbed rest from fearful dreams and nausea with disgust for food.

Examples of true polypus of the heart are infrequent even amongst the exceptional cases of disease. An instance has been reported by Dr. Douglas, who gives the following summary of the signs which were presented:*—The patient was a gentleman, aged 35, of large frame and development. There was a rapid development of the symptoms. A previously robust state of health. Dyspnœa, with an absence of signs of pulmonary obstruction. Persistent hurry of the circulation. Reflex nervous irritation with a kind of hysterical breathing; paroxysmal cough without expectoration; retching, semi-convulsive attacks, and tearing substernal pain. Delayed obstruction of the circulation through the lungs, the kidneys, and the liver. Anasarca delayed, but rapidly developed. Pulse small and regular. Contrast of a more marked cardiac impulse than radial pulse. Absence of cardiac murmur. Assimilation in the “clang” of the heart’s sounds. Death occurred after one of those semi-convulsive attacks which usually ended in syncope. At the necropsy, on opening the left ventricle, the rounded nodulated extremity of a tumour was seen projecting through the mitral orifice. On opening the left auricle, this tumour was found growing from its

posterior wall; of such bulk as seemed nearly to fill the cavity of the auricle, and hanging downwards, its point projecting into the left ventricle. The tumour was 4½ inches long, 2½ broad, and 1½ deep at its deepest part. Its superficial and dependent part was coated with some layers of coagulated fibrin, and it presented nodules of a translucent appearance; but its base was organically connected with the auricular wall, and was dense in structure. On the outer side of the auricle, opposite the point where the tumour had its attachment, there were small outgrowths of a structure identical with that of the tumour itself; this structure being afterwards found rich in cells, many of them resembling connective tissue bodies, but none having the appearance of typical cancer cells. There was no coagulum in the auricular appendage, nor between the bands of the columnæ carnae. The right side of the heart presented no abnormality. The pulmonary veins were open; and the valves of the heart were healthy.

Dr. Morgan exhibited at the Manchester Medical Society, in March, 1866, a preparation which he believed to be unique. The patient, 28 years of age, had suffered from one or two attacks of rheumatic fever. He had a complicated cardiac murmur, partly exocardial and partly double mitral. Death took place very gradually. At the subsequent examination it was found that the right auricle contained a loose tumour, about as large as a pigeon's egg, composed of phosphate of lime and fibrous strumæ. This tumour had evidently grown from the wall of the auricles, had become detached, and had then rolled about in the current of blood; for both on its surface and on the inside of the wall were to be seen the remains of a pedicle. Another tumour, still small, was also in process of formation. The auriculo-ventricular valve was worn away at one part by the attrition of the substance.

In a case of rupture of the heart shown to the Pathological Society by Dr. Moxon in February, 1866, there was seen, on cutting into the substance of the septum of the left ventricle, a pale cheese-coloured fibrinous mass, resembling decolorized blood-clot. Dr. Moxon expressed his belief that deposits such as this, which are nearly always in the septum, are none other than clots formed in the substance of the ventricular wall by injury to the vessels, occurring in ruptures that are not sufficiently extensive to reach either surface of the wall.

According to Dr. Oppert, up to the year 1867, eight cases of syphilomata of the heart had been recorded in medical literature. The little tumours appear to have given rise to pain, irregular action of the heart, palpitations, dyspnoea, &c.; while sometimes a slight systolic murmur was noticed. The histories show that these growths are liable to soften, and that they may produce ulceration of the heart and embolism. Their diagnosis must
be made through the presence of syphilitic affections of other organs.

Occasionally a cure can be hoped for from the use of specific remedies, provided they are employed at an early period before degeneration of the muscular tissue has set in.

Where the syphilitic deposit on the walls of the heart has taken place slowly, there has been found hypertrophy of the organ. In an instance related by Ricord, the constitutional infection was of long standing; the first sore being contracted in 1824, while death from syphilitic degeneration of the muscular fibres of the heart did not happen until 1845. Mr. Morgan, of Dublin, has published the medical history of a prostitute who had sores on the genitals eighteen years before death took place, in July, 1863, from the formation of gummatas in the walls of the ventricles.

'Cases of primary cancer of the heart are very seldom met with. Less uncommon are instances where the malignant disease has spread to the heart from adjacent organs,—from the glands in the neck, the bronchial glands, or the lungs. But most frequently where the heart is invaded by cancer, this affection has occurred secondarily: there either is or there has been malignant disease in some other organ of the body.

Cancer of the heart, whether primary or secondary, has rarely given rise to such symptoms that its existence has been diagnosed during life. In a case of this disease, which was under the care of Dr. Peacock at the Victoria Park Hospital, and in which particular attention was paid to the heart because it appeared clear that there was a tumour in the chest, and the patient stated that his father died of cancer of the heart, yet no symptoms specially indicating that the heart was involved could be detected.

The cancerous deposit, which is most frequently of the medullary kind, may be found about the pericardium, or in the muscular substance of the heart. In an instance reported by Dr. Bright, a thick layer of yellow malignant disease covered the whole of the visceral and parietal portions of the pericardium: so that this fibro-scorous membrane was glued to the heart. The external wall of the right ventricle has been found occupied by a large knotted tumour, looking like a supernumerary heart, and formed of medullary cancer. In addition to masses of cancer involving the walls of the heart, the columnae carneae, and the musculi pectinati, we find that the surfaces of one or more of the valves may have cancerous vegetations impeding the proper closure of the openings.
XII. FUNCTIONAL DERANGEMENT OF THE HEART.

The disorder now to be considered is of special importance on account of the mental distress to which it gives rise. For it is a curious feature in medical practice, that whereas patients with grave structural disease of the heart (prior to the occurrence of the secondary evils) seldom consider that there is anything radically wrong, individuals with mere deranged action can scarcely be persuaded that they are not doomed to an early and sudden death. The latter are unable to understand how indigestion, fast living, the abuse of tobacco and tea, or severe mental labour with insufficient bodily exercise, can produce palpitation with an intermittent pulse; while the physician who assures them that there is no cardiac disease, is either regarded as one ignorant of his business, or as a good-natured fellow afraid to tell an unwelcome truth.

Functional disorder can closely simulate organic disease of the heart. There may be an irregular feeble pulse, palpitation, and fluttering; with a cardiac murmur and subcutaneous oedema in anaemic subjects. A systolic murmur, sometimes audible at the base and apex, may even be heard in a few healthy individuals under the influence of great nervous excitement. The local suffering is usually greater than in organic disease; the patient complaining either of a dull wearying ache in the precordial region, or of occasional lancinating pains. Frequently there is inability to lie on the left side, owing to tenderness. There is always great depression of spirits; the digestive organs are deranged, flatulence and acid eructations being especially common; a sense of choking, or of the rising of a ball in the throat, is complained of; and there may be occasional attacks of giddiness, faintness, headache, noises in the ears, flushing of the face, violent pulsation in the porta and other arteries, &c. There is rarely any dyspnea, if the blood be healthy; and even when the breathing is hurried the patient hardly refers to it, all his thoughts being fixed on the palpitation or thumping of his heart, and the pain.

Some remarkable examples of unusually rapid action of the heart are to be found recorded in the medical periodicals. In one instance, a patient who consulted Dr. Cotton, had a pulse too rapid to be counted; the respirations were forty; while the pulsations of the heart were 230 in a minute. Three weeks after the commencement of the attack, the action of the heart suddenly became natural in every respect, and the pulse fell to 80. Four or five similar attacks took place; most of these ending in recovery while the patient was taking digitalis. Dr. Cotton believes that such rapid action of the heart, when unconnected with organic mischief or
inflammatory disease or displacement, must be due either to the heart being so extremely sensitive that it contracts upon the healthy blood before the cavities have got filled; or else the blood is of such an abnormal and irritating character, that it excites premature contraction. One symptom remained after recovery from the last attack, viz. pulsation of the right jugular vein; this being probably due to the tricuspid valve allowing of regurgitation. Why the valve should continue incompetent, and should not give rise to a regurgitant murmur, are questions difficult to answer.* A similar instance happened in the practice of Sir Thomas Watson; where the beatings, "or rather the waggings," of the heart were found to number 216 in the minute. There was no murmur. In a day or two, the inoripinate action suddenly ceased, and the pulse numbered 72. During a third seizure, the attack suddenly passed off while Sir Thomas Watson was present. A fourth attack proved fatal. At the autopsy the heart was found large, as if it had been distended; while the muscular walls were very thin and soft. No other morbid state could be detected.

Another form of functional disturbance of the heart is an intermittent action. The heart beats steadily and equably for a certain number of times, and then a pulsation is missing. By very careful auscultation it can generally be made out that the contraction is not altogether absent; a feeble first sound may be heard, and perhaps a second sound in the pulmonary artery, but not in the aorta. Intermissions of this kind may be due to dyspepsia or temporary debility or to tobacco, but they may also be habitual and persist for years in individuals enjoying robust health and living to an advanced age. This intermittent pulse is probably attributable to impaired innervation of the heart, and according to Dr. Richardson it often dates from some severe shock to the system, physical or moral.

To prevent any error in the diagnosis of functional from organic affections of the heart, the physical signs of valvular disease (as already described) must be borne in mind. Moreover, the patient ought to be examined with the greatest care; and the practitioner if in doubt, should reserve his opinion until he can make a second investigation. The disease perhaps most likely to be overlooked is fatty degeneration, especially if the pulse be temporarily hurried and the cornice appear healthy.

Functional disturbance of the heart often occurs in cases of hysteria, ovarian or uterine irritation, neuralgia, and anaemia; it is frequently complained of by women at "the change of life;" it may be associated with the derangements due to nervous exhaustion,—such as over study, mental anxiety, sexual excesses, &c.; morbid states of the blood, gout, rheumatism, or chronic disease of the

* British Medical Journal, p. 630. London, 1st June, 1867. The case by Sir Thomas Watson is at p. 752, 22nd June, 1867.
liver can produce it; the use of tobacco or strong tea not uncommonly originates it; and lastly, it is a frequent result of all forms of dyspepsia.

The object of our treatment must be to allay the symptoms, while we also endeavour to remove their source. The cause of the suffering ought to be fully explained to the patient, and he must be led to feel confidence in our ability to cure him. An incipient attack of palpitation may frequently be cut short by a few deep inspirations, and nothing is more encouraging to a nervous sufferer than to find his dreaded symptom capable of control by so simple a proceeding. To quiet the circulation, antispasmodics and sedatives and special tonics will be needed. Perhaps few remedies of this description answer better than ammoniac, ether, sumbuls, henbane, belladonna, hop, opium, &c. (according to F. 86, 93, 95, 326, 337, 361). The official belladonna or opium plaster, applied over the preaordia, gives relief. Where the patient can bear digitalis, which most probably acts as a cardiac tonic, this drug (F. 334) will prove very useful. Supposing it be desirable to effect a compromise in the treatment,—to feel one's way, the American wild cherry (F. 333) can be prescribed instead of digitalis. If there be constipation with unhealthy secretions, a warm aperient (F. 146, 149, 162) should be ordered. Then, if the deranged cardiac action appear to have any connexion with gout, saline effervescing draughts with colchicum (F. 46, 348, 352) ought to be administered. Where there are acid eructations with dyspepsia, bismuth, soda or potash, hydrocyanic acid, laurel water, &c. (F. 65, 67, 70) will be necessary; followed at the end of a few days by the nitro-hydrochloric acid in some bitter infusion (F. 378). Pepsine (F. 420) frequently does good in these cases of dyspeptic misery, although it will be useless without particular attention to the diet. The patient who cannot afford time to eat his meals quietly, and to masticate his food thoroughly, must bear his troubles. The practitioner will have to see that the teeth and gums are in a proper condition. It is astonishing that people should expect to enjoy good health, while their gums are sodden and filled only with decayed teeth and useless stumps. In these days of painless dentistry and the skilful adaptation of artificial teeth, every mouth ought to be clean and sound. Supplementary to the foregoing, the use of tobacco and tea should be forbidden; while it must be remembered that malt liquors more frequently than not disagree. A small quantity of brandy in iced soda water is generally most suitable. And lastly, if there be symptoms of nervous exhaustion, or if the patient be anemic, steel will be required. The best preparations in these cases, as a rule, are the citrate of iron and ammonia (F. 401, 403), the reduced iron (F. 394, 404), the citrate of iron and strychnia (F. 408), or quinine and iron (380).
XIII. INTRA-THORACIC TUMOURS.

An intra-thoracic tumour may be aneurismal, cancerous, sarcomatous, adenoid, fibrous or fatty; or it may be formed by an abscess. Putting aside the cases of aneurism, we find that the other tumours, whatever be their nature, commonly have their origin in the connective tissue and glandular structures, and are developed in the mediastinum. The symptoms they produce are chiefly due to the pressure exerted on the heart or lungs, or on the nerves or vessels, and are exceedingly variable, differing according to the structures involved. There may be no indications of disease for a time, as a tumour often attains some size before it interferes with the circulation or the respiration.

When the root of the lung is involved, we find more or less pain, restlessness, cough, dyspnoea or even orthopnoea, frothy or viscid expectoration, palpitation, hoarseness, and every now and again haemoptysis. The tumour may produce pleurisy, with effusion, which is often bloody when the disease is malignant, bronchitis, pneumonia, pulmonary gangrene, or if a main bronchus be obstructed, pulmonary collapse. The trachea or oesophagus may be compressed, the heart displaced; the vena cava or one or both of the innominate veins or the vena azygos may be obstructed or even obliterated; more rarely the aorta may be constricted. Dulness on percussion becomes more marked as the growth protrudes into the anterior mediastinum, and it may bulge out the ribs or sternum, or protrude through the intercostal spaces; the auscultatory signs will vary according to the nature of the secondary phenomena.

Primary hydatid disease of the lung, or of the mediastinal structures, is hardly ever met with. In cases where hydatids, or portions of their cystic membranes, are expectorated, the original seat of the parasitic growth has been the liver. At least, this has been the case with the great majority of instances.

With regard to cases of primary cancer involving the root of the lung, it is remarkable that inflammatory condensation of the pulmonary tissue, with disorganization and abscess, may result comparatively early. In the only three examples of this rare and obscure disease which fell under Dr. George Budd's observation at King's College Hospital, during nearly twenty years, the tumour implicated the root of the right lung. The extent of change in the lung in these three cases was greater as the tumour was larger, and involved more completely the root of the lung; while in all, the left lung was free from adhesions, and presented only those appearances which result from recent congestion. As to the way in which these changes arose, Dr. Budd suggests that they resulted

from the tumour involving and destroying all or a greater part of the pulmonary nerves; and consequently the inflammatory affections of the tissues of the lung in these instances are analogous to that destructive inflammation of the eyeball which results from disease involving the fifth nerve within the orbit. The lung resembles the eyeball in this respect, that all the nerves which supply it are comprised at its root in a very small space, so that they can there be destroyed or paralyzed (and the organ, in consequence, be deprived entirely of nervous influence) by disease of no very great extent.

Mediastinal cancer is seldom primary. It may occur secondarily to disease of distant organs, or it can possibly spread from the lungs. The fatal termination in mediastinal tumour, whether this be cancerous or not, often takes place slowly; the patient's sufferings from impeded respiration, want of sleep and appetite, debility and anæmia, gradually increasing until he dies anæmico and exhausted. Sometimes, however, death takes place almost suddenly from haemorrhage, from thrombosis, or from spasm of the glottis. All that art can do in these very distressing cases is to palliate the prominent symptoms. Great temporary relief may, however, be often given by the cautious use of diuretics or of aperients; by dry cupping; by inunction with the ointment of red iodide of mercury (one part of the official ointment to three of lard), or by freely rubbing in the compound iodine ointment (equal parts of the ointment and cod liver oil); by venesection, to the extent of six or eight ounces, if symptoms of pulmonary or cardiac congestion predominate; and by employing antispasmodics,—such as ether, spirit of chloroform, ammonia, opium, belladonna, stramonium, &c.

XIV. AORTITIS.

Aortitis [from Αόρτη = the great artery; terminal-itis], or acute inflammation of the aorta, is such a very rare affection that some physicians almost doubt the possibility of its occurrence. On all hands it is allowed that the mode of origin of the inflammation is unknown. It can only be said that aortitis is probably a blood disease.

The symptoms are so obscure, that aortitis is seldom diagnosed. In the recorded cases there seems principally to have been great general uneasiness, rigors followed by fever, orthopœca with a frequent sense of suffocation, pain and violent pulsation of the vessel, and a great palpitation of the heart. In a very interesting case reported by Dr. Parkes,* a loud, rough, systolic bruit, due to the passage of the blood over a surface roughened by a deposit of

* * The Medical Times, London, 23rd February, 1850.
lymph, was heard from the third dorsal vertebra down into the lumbar region; while the pulse was irregular and small, though this arose from the aortic orifice of the heart being diseased. The pulse is often unaffected.

The appearances found after death seem to consist of great vascularity, with a thickened pulpy state of the inner and middle coats of the artery. Lymph has sometimes been effused on the internal tunic. On the same membrane small yellow deposits are occasionally seen as the result of syphilis. From the few cases on record it would seem that inflammation of the aorta is very seldom associated with endocarditis,—less frequently indeed than with pneumonia or with pleurisy.

With regard to treatment, it is only necessary to say that when the existence of this disease is suspected, warm baths, dry cupping over the spine, counter-irritation by means of blisters, and the administration of iodide of potassium and opium, are the measures to be resorted to. Colchicum might perhaps do good; while ether could be tried to relieve the dyspnoea.

XV. AORTIC PULSATiON.

Aortic pulsation is a peculiar functional affection which is characterized by violent throbbing, this being usually most observable in the abdominal portion of the vessel. It causes annoyance rather than pain: but at times produces sickness and syncope. The pulsation may frequently, in thin subjects, be seen at the epigastrium, and sometimes at the umbilicus. On applying the hand, a jerking, quick, strong forward impulse is felt; which is synchronous with the heart's systole. Auscultation will possibly detect a systolic bellows-murmur; such being due to anaemia, or to the compression exerted by a tumour lying over the vessel, or to displacement of the artery by disease of the vertebra, or to simple pressure with the stethoscope. The diagnosis between functional and aneurismal pulsation is somewhat difficult, particularly if any cancrums or non-malignant growth be situated over the vessel.—I have found this pulsation not uncommon in cases of uterine disease. It has been frequently noticed in hypochondriac, in those whose digestive organs are deranged, in structural affections of the stomach and duodenum, in gouty patients, in chlorotic females, in association with exophthalmic goitre, &c. Certain foods may also give rise to it, especially strong green tea and tobacco.

The treatment must be directed to the removal of the cause. In a case which was under my care during the year 1853, in the Hospital for Women, the pulsation produced so much sickness and distress that it was frequently necessary to control it by the
application of ice to the abdomen, and by the administration of morphia. Hohnbaum, who suffered for some years from this disease in connexion with dyspepsia, says that he derived the greatest relief from the use of the aperient waters of Carlsbad, change of air, and complete relaxation from his professional duties. In most cases considerable benefit will arise from the employment of bark and some mineral acid, or from quinine and steel, or from phosphate of zinc and nux vomica; from attention to the functions of digestion; from friction along the spine with a liniment containing belladonna; as well as from sea-bathing. The diet ought to be nourishing; substituting dry sherry or brandy and water for beer, and milk (or cocoa made with milk) for tea and coffee.

XVI. CONTRACTION AND OBLITERATION OF THE AORTA.

That contraction of the aorta, sometimes going on to complete obliteration, may occasionally occur near the termination of the arch of the vessel (about the point where the ductus arteriosus is united with it), has been well known since M. Reynaud recorded an example of the kind in 1828.

From an elaborate analysis of forty cases by Dr. Peacock,* it appeared that the aorta gradually diminished in size, or the contraction commenced abruptly; that when abrupt, the vessel often looked as if a piece of string had been tied round it; that the internal tunics were frequently more contracted and thickened than the external; and that in ten instances the obliteration of the canal was complete, while in the remainder the contraction varied, so that in some only a probe could be passed through the stricture, though in others the little finger might be introduced. The ascending portion of the arch was generally dilated, whilst the coats were thickened or atheromatous or osseous; but below the seat of stricture the vessel was often dilated, and then became contracted. Although the blood had been conveyed imperfectly, or not at all, by the trunk of the aorta from the upper into the lower portion of that vessel, yet the circulation had been maintained with considerable freedom in the lower parts of the body by a compensatory collateral circulation; the collateral channels, however, affording a less free passage than the healthy vessel would have done. Hence, the changes produced in the heart consisted chiefly of hypertrophy and dilatation of the cavities, such as might arise from any form of aortic obstruction. The patients were of all ages, from a child twenty-two days old, to a man who was ninety-

two; and the defect was more common in males than females. Death occurred, in one set of cases, from acute or chronic diseases, having little or no connexion with the morbid condition of the vascular system; in a second set, the death was sudden, and traceable to the condition of the aorta; while in the largest proportion, the patient's sank with symptoms of cardiac asthma and drowsy, sometimes complicated by pneumonia, bronchitis, pericarditis, erysipelas, sloughing, purpura, &c. Dr. Peacock agrees with those writers who regard the stricture as originating in, or being connected with, some error in the original conformation of the vessel.

XVII. ANEURISM.

Three principal forms of Aneurism [from 

Aneurisme to dilate] are usually described. True aneurism, in which all the coats of the artery dilate and unite in forming the walls of the pouch; false aneurism, in which the inner and middle arterial tunics being ruptured, the walls are formed by the cellular coat and contiguous parts; and mixed or connecutive false aneurism, in which the three coats having at first dilated, the inner and middle ones subsequently rupture as the distension increases. The same meaning, however, is not always attached to these names by authors, and the varieties are not distinguishable during life, not always indeed after death. When the two inner tunics are ruptured, and the blood forces its way between them and the outer coat by a kind of false passage so as to form a spreading diffused tumour, the disease is known as a dissecting aneurism. And lastly, varicose aneurisms are those where a communication has formed between the aorta and either of the venæ cavae, or between the aorta and one of the auricles, or between this vessel and the right ventricle, or between the aorta and the pulmonary artery.* The latter is much more common than either of the other varicose aneurisms.

Aneurism of the aorta may be caused by a sudden strain or by injury, but usually the inner coat is first weakened and its elasticity impaired by atheroma. It is more common in men than in women, and in men whose occupations call for occasional sudden and powerful efforts, or require sustained exertion in a cramped position, as miners, colliers, hammer men, sailors, grooms, &c. Mr. Myers, of the Coldstream Guards, has shown that aneurism is unduly common among soldiers in consequence of their ill-adapted cloth-

* For examples of all these forms of varicose aneurism the reader should refer to a paper by Mr. Thurnam in the Medico-Chirurgical Transactions, vol. xxiii. p. 323. London, 1840. In the same work (vol. xlii. p. 211. London, 1861), there is an account of a case of Aortic Aneurism, in which a communication with the Pulmonary Artery was recognised during life, by Dr. Willoughby Francis Wade.
ANEURISM OF THORACIC AORTA.

According to the Registrar-General's Returns, there were in the year 1866, in England, the following number of fatal cases of aneurism, viz., Males 175 - 450. In males the greater number of deaths occurred between the ages of 25 and 35; in females, between 45 and 50. The average annual mortality from this disease, in both sexes, for the ten years 1857 to 1866 has been 402.

The number of deaths from aneurism appears to be steadily increasing, the proportion in 1870 having been 28 to 1,000,000 persons living as compared with 17 in 1854. How much of this increase is due to improved diagnosis, and how much to an actual increase of the disease from greater exposure to arterial strain in some classes of the population, cannot be determined.

Aortic aneurism is a disease of the middle and somewhat advanced periods of life, rather than of youth. It often results from ossific or calcareous deposits, or from atheromatous or fatty degeneration of the coats of the vessel, or from corrosion of the coats produced by some syphilitic deposit; and consequently other vessels are not uncommonly found affected at the same time. When the tumour is small, its existence frequently goes undetected; the diagnosis under such circumstances, as well as during the early stages, being obscure. Death generally results from haemorrhage owing to rupture of the sac; but it can also occur suddenly without any rupture, as from suffocation; or it will take place gradually from exhaustion caused by the long-continued suffering; or it may be due to debility brought about by the repeated escape of small quantities of blood; or it may happen from coexistent tubercular consumption.

1. ANEURISM OF THORACIC AORTA.

This disease is chiefly met with in the ascending portion, or in the transverse part of the arch of the vessel.

The symptoms and physical signs of thoracic aneurism will vary according to the part of the aorta affected and with the stage of the affection, and the diagnosis will be extremely difficult or unmistakably obvious in different cases and in different stages of the same case. The symptoms will arise on the one hand from disturbance of the circulation, and on the other, from pressure on neighbouring organs and parts. Of these the various pressure effects are the most important. Among them are displacement of the heart downwards, pressure on the root of the right lung, on the vena cava superior, or right innominate vein, on the recurrent laryngeal nerve, on the sympathetic nerve, on the trachea and oesophagus, on the left innominate vein, on the root of the left lung, according as the aneurism springs from the ascending aorta, the arch, or the descending aorta. Again the aneurism may corrode and penetrate the thoracic parietes or the vertebrae, giving
rise to pain from pressure on the nerves, or may burst into the pericardium or one or other pleura, or into the trachea or esophagus, or even into the spinal canal.

It is curious that occasionally aneurismal patients expectorate blood, to the extent of several ounces, for weeks or months before death. Dr. Gairdner has recorded a case in which the first gush of blood took place four years and eight months before the patient's death; blood being also expectorated in varying quantities at different times during this period. I have already mentioned the case of Mr. Liston, in which five months elapsed between the first and only attacks of haemoptysis when many ounces of arterial blood were brought up, and death.

The effects on the circulation may occasionally resemble those produced by disease of the heart; other and more characteristic effects are modifications of the pulse appreciable by the finger or shown by the sphygmograph.

The physical signs when present will be some or other of the following:—a pulsating tumour, dulness on percussion, impulse, thrill, murmur, or other sounds audible over the sac.

Aneurism of one of the sinuses of Valsalva at the root of the aorta may cause no symptoms till it proves fatal by bursting into the pericardium. Occasionally it gives rise to angina pectoris, and sometimes to a murmur or thrill.

Aneurism of the ascending aorta when saccular usually projects towards the right, as this side of the vessel is subjected to the greatest distending force. Dulness to the right of the upper part of the sternum, pulsation in this situation perceptible at first perhaps only on a deep expiration, accompanied or not by murmur, but generally attended with the diastolic shock characteristic of aneurism, are the physical signs to which it may give rise. The structures liable to be affected by pressure are the inferior vena cava, giving rise to obstruction to the return of venous blood from the head and upper extremities, the root of the right lung, and perhaps the phrenic nerve, while the heart may be displaced downwards. The pressure effects mentioned are not often present however, as the aneurism usually makes its way forwards, and it may project as a pulsating tumour. When the aneurism is sufficiently high in the vessel to involve the root of the innominate artery, the pulse in the right wrist and carotid may be enfeebled and altered in character or even extinguished.

General tubular dilatation of the ascending aorta is not uncommon. The existence of this condition may be recognised by dulness outside the right edge of the sternum, an abnormal amount of impulse, and especially by the loud sonorous character

of the second sound, which is also audible over a larger area than usual. Sometimes in these cases the mouth of the aorta is so much stretched, that the valves, though not diseased, are incompetent to close it, and a diastolic regurgitant murmur is heard.

Aneurism of the arch of the aorta may give rise to different effects according as it springs from the convexity or concavity, or one or other aspect of the vessel. An aneurism of considerable size may be lodged among the parts in the mediastinum, so as to yield only obscure physical signs, such as dulness, impulse, murmur, shock, or thrill. On the other hand, the symptoms may be varied; pressure on the vena cava or left innominate vein, obstructing the return of blood; pressure on the left recurrent laryngeal nerve, producing a cracked state of voice and spasm of the larynx; on the sympathetic, causing contraction of the pupil; on the trachea, giving rise to dyspnnea; or on the oesophagus, giving rise to dysphagia. When the origin of the left carotid or subclavian is involved, the pulsation in the branches of these vessels may be modified.

Aneurism of the descending aorta is still more difficult of detection through physical signs, and frequently its existence is unsuspected up to the moment of its rupture into the pleural cavity. A frequent effect is erosion of the vertebra and pressure on the nerves as they issue from the intervertebral foramina, attended with acute lancinating pain shooting round the side. Occasionally the root of the left lung is compressed, or there may be pressure on the oesophagus, and eventually ulceration into this caudal.

In some cases of aortic aneurism there is destructive inflammation of the lung, attended with violent cough, dyspnoea, pain, and perhaps haemoptysis; the inflammation and gangrene being due either to compression of the pulmonary vessels cutting off the supply of blood, or perhaps to pressure on the pneumogastric nerve diminishing the nervous force, and consequently interrupting the nutrition of the affected lung.

2. ANEURISM OF ABDOMINAL AORTA.

Abdominal aneurism often gives rise to acute pain in the back, and whenever in an adult, especially if the occupation have been such as to require sudden and powerful efforts, there is severe and persistent pain here, not explained by lumbago or other obvious cause, the possibility of aneurism should be borne in mind. There may also be pain shooting into either hypochondrium, and extending downwards into the thighs and scrotum. Constipation aggravates the pain, while lying on the face often affords remarkable relief. By careful examination a tumour may generally be felt, which communicates a constant and powerful pulsation to the...
hand, and on applying the stethoscope a short, loud, abrupt bellows sound will be heard, but sometimes, and especially when the aneurism is situated between the pillars of the diaphragm, it may remain deep seated and ill defined, so as to be recognised with extreme difficulty. As aneurism here has been known to displace the liver forwards and downwards, and to point below the false ribs in the back.

In the diagnosis of aneurism it is necessary to remember that simple or malignant tumours having their seat over the healthy artery, receive pulsation from it. Moreover, if such growths cause much pressure upon the aorta they may produce a murmur. Our diagnosis must be made by a consideration of the history; by noticing that aneurisms pulsate from the, first, while tumours only appear to do so when they acquire some size; by remembering that tumours are hard and firm from the commencement, whereas aneurisms only become so subsequently; and by observing that gentle continued pressure will often diminish the size of an aneurism.

The treatment of aortic aneurism—whether thoracic or abdominal—must consist in recommending the avoidance of all bodily and mental excitement; in giving relief to the pain, cough, dyspnoea, and other prominent symptoms; in allowing the use of a generous reparative diet, with a little wine or brandy and water, but forbidding malt liquors of every kind; and in paying attention to the digestive, secretory, and excreting functions. By absolute rest and a regulated diet, the amount of fluid being limited and the food being taken in small quantities at intervals of 3 or 4 hours, so as to avoid distending the vascular system by the digested products of a full meal, a cure is sometimes obtained, the sac becoming filled with layers of fibrin and a solid tumour resulting which ceases to increase in size.

The method of cure proposed by Valsalva and Albertini, and which has been since often adopted up to the present time, involves the bleeding of the patient frequently, and the keeping him upon the lowest possible diet compatible with the sustenance of life. By this means it was thought that the force and velocity of the blood would be diminished, and that coagulation would take place in the aneurism. Since, however, the coagulation of fibrin seems to be impeded by diminishing its quantity, and as the rapidity of the heart's action and the throbbing of the arteries are increased by depletion, Valsalva's method would seem to produce effects the very opposite to those wished for; and such is the fact. Dr. Copland says he has seen cases "in which aneurismal tumours had existed for some time without any increase, so long as the patient avoided any marked vascular excitement and continued his accustomed diet; but when repeated depletious and vegetable or low diet were adopted, great augmentation of the tumour, and fatal results followed."
ANEURISM OF ABDOMINAL AORTA.

In advanced and aggravated cases we can only endeavour to palliate the various symptoms as they arise. Thus the pain and depression will always be moderated by opium, which may often be advantageously used in the form of subcutaneous injections; the harassing cough may generally be relieved by sedatives and expectorants; the paroxysmal attacks of laryngeal dyspnoea, when threatening the extinction of life, might be removed by the careful performance of tracheotomy; the dropsy can be often lessened by mercury, digitalis, squills, juniper, juice of broom, and other diuretics; while the heart's action may be regulated and moderated by assafetida, camphor, digitalis in small doses, and particularly byaconite. With all cases, experience no less than common sense teaches us to avoid too debilitating a plan of treatment. This is especially proved by the fact, that of all the causes of aneurism a degeneration of the arterial coats is the most common. Nevertheless, where there is considerable pulmonary congestion, or when the pressure of the aneurism is giving rise to very severe suffering, a small vena section may often afford relief; the lowering effects of the loss of blood being compensated for by a liberal diet.

Since the fourth edition of this work was published in 1861, various special methods of treating aneurismal tumours have been proposed:—(1) The first plan consists in the introduction of a quantity of fine iron wire into the aneurism, with the object of affording an extensive surface upon which fibrin may coagulate. This practice was adopted by Dr. Murchison and Mr. Charles H. Moore in a case of saccular aneurism of the ascending aorta projecting through the anterior wall of the left side of the chest; upwards of twenty-six yards of wire being passed through a small pointed cannula inserted into the tumour. The treatment was unsuccessful, but it was not adopted until it was clear that the patient could not live many days.

(2) Another plan is by galvano-puncture. A long needle insulated to within an inch of its point by a thin coat of silk and gutta percha is pushed into the aneurism, and is connected with the negative pole of a battery of from four to eight cells; the positive pole formed by a plate of zinc resting on a piece of lint moistened with salt and water is applied to the skin near the tumour, and a galvanic current is passed through the sac. Coagulation of blood takes place round the needle, and more or less consolidation is obtained. Up to the present the failures by this method have been more numerous than the successes, but it has usually been applied in desperate cases.

(3) It has been proposed to tie the left carotid artery in aneurism of the arch of the aorta, this proceeding being suggested by the occurrence of spontaneous cure when this vessel has been blocked up by a clot.

(4) Dr. William Murray, of Newcastle-on-Tyne, has had the satisfaction of curing a case of aneurism of the abdominal aorta,
and of setting an example which has been followed with success by many others, by compression of this vessel immediately above the tumour. The first attempt failed; but on the 19th April, 1864, the patient (a man twenty-six years of age) was kept under the influence of chloroform for five hours, during which time pressure was maintained by a properly constructed tourniquet. It was only, however, during the last hour that pulsation in the tumour could be found to have almost ceased on the removal of the instrument; the tumour having become quite pulseless by the evening. Three months afterwards the man was at work as an engine-fitter; the tumour being scarcely appreciable, while the aorta and iliacs and femoral arteries were quite pulseless. This case proves that the aorta has been occluded without either temporary or permanent serious disorder, and that there must be a collateral system of vessels so complete as to carry on the circulation when the aorta is blocked.* Dr. Murray believes that in the rapid pressure treatment of aneurism the cure takes place by the coagulation of the blood in the sac, and not by the deposition of fibrin. To prevent any mishap or failure the patient must be thoroughly under the influence of some anaesthetic, so as to permit the application of a powerful pressing instrument on sensitive parts, as well as to restrain all muscular action; for success depends upon the complete arrest of all movement of the blood in the aneurismal sac, with retention of this fluid in a motionless state, just as happens from the application of a ligature to the artery above the seat of disease. Great care is also required in the choice of the position at which the tourniquet is to be applied, and to avoid undue compression and bruising of the abdominal viscera. Dr. O'Ferrall has advised the use of distal as well as proximal pressure, a suggestion which has been successfully carried out by Dr. Mapother. Distal pressure, however, is seldom needed in the treatment of aneurisms requiring pressure on the abdominal aorta; since, as Dr. Murray remarks, the collateral circulation to the lower parts of the body is here so limited as to render a current into the distal orifice of the aneurism improbable. As regards the duration of the treatment we are not in a position to lay down any rule. It must depend on the cessation of all pulsation in the tumour. In an example of aneurism of the abdominal aorta treated by Dr. Heath, at Sunderland, consolidation occurred within twenty minutes of the second attempt; the first trial, with irregular pressure for ten hours, having failed.

(5) Dr. William Roberts, of Manchester, has recorded a case of aneurism of the arch of the aorta making its way through the parietes of the chest, which was treated by iodide of potassium in

* Medico-Chirurgical Transactions, vol. xlvi. p. 187. London, 1864. A further report of the case, showing that the cure was complete, is to be found in the Medical Times and Gazette, p. 383, 15 April, 1865. See also the British Medical Journal, p. 287. London, 5 October, 1867.
Diseases of the Pulmonary Artery.

Although the diseases which affect the pulmonary artery are important, yet they have scarcely attracted as much attention as they merit. This is in some measure owing to their comparative rarity, and partly to the obscurity which clouds their diagnosis.

Examples of inflammation of the coats of this vessel have occasionally been met with. The reports of many of these are, however, but of little value; since the cases occurred when our knowledge of the spontaneous coagulation of the blood during life was very imperfect, and when the presence of a fibrinous deposit in an artery (thrombosis) was regarded as a consequence of inflammation. In the very excellent work of Dr. Norman Chevers† it is stated that acute inflammation of the pulmonary artery is found to occur under the following circumstances:—(1) As a sequence of phlebitis. (2) In cases of Bright’s disease, and in persons habitually intemperate. (3) As a result of exposure to cold, and from rheumatism. And (4) as an accompaniment of certain forms of pneumonia.

The chief sign which Dr. Chevers seems to rely upon as showing that inflammation has been present is the occurrence of adherent clots in the vessel; but it has been argued by Sir James Paget and others that discharged blood (such as that contaminated with urea) has a greater tendency to adhere to the walls of the vessels than clots which are healthy.

Morbid growths are very seldom found in the pulmonary artery. Dr. Chevers quotes the history of an illustrative case which occurred in the practice of Dr. Edmund L. Birkett. The patient was a poor

† Collection of Facts illustrative of the Morbid Conditions of the Pulmonary Artery, p. 82. London, 1851.
DISEASES OF THE PULMONARY ARTERY. [ART V.

woman, 25 years of age, "inhabiting an ill-ventilated room in a badly-drained part of Bermondsey," who had been frequently subjected to exposure to cold, and who in consequence had suffered from several attacks of thoracic inflammation. When visited, fourteen days after the commencement of her illness, her aspect was anxious and distressed; there was great dyspnœa, almost amounting to orthopœna; she had a slight cough, without any expectoration; and the pulse was feeble, quick, sharp, and vibrating. She complained much of pain about the precordial region, and of palpitation. The heart's action was tumultuous, its rhythm normal, and its impulse stronger than natural. Death took place about six weeks after Dr. Birkett first saw her. At the autopsy there were found,—extensive old pleuritic adhesions, with congestion of the lungs; a smooth pericardium, white and opaque at parts; a large heart, with its nutrient vessels much gorged; while "within the pulmonary artery, at its point of division, was a circular space as large as a fourpenny-piece, surrounded by a ring of vegetations, to which was slenderly attached a mass of the size of a large walnut, of a yellowish colour, and in substance resembling the roe of a mackerel."

The canal of the pulmonary artery may become contracted or obstructed. These conditions are generally due to the formation of a fibrinous clot; or they can arise gradually owing to the pressure of a cancerous or innocent tumour, or to that exercised by an aortic aneurysm, or to that produced by extensive thoracic effusion in double pleurisy. Dr. Barlow has especially directed attention to the cases of young patients, who from birth have suffered from an ill-developed condition of the respiratory apparatus, in connexion with congenital narrowing of the pulmonary artery. In all such cases, either constant or only paroxysmal, dyspnœa is a prominent symptom. Dr. Chevers was the first to point out the distinctive circumstance that, in a large proportion of cases, individuals suffering from great narrowing of the pulmonary artery, select the recumbent position, either habitually or during the paroxysms of difficult breathing; while the subjects of any other form of obstruction to the circulation through the lungs, or through the left heart, breathe most freely when the shoulders are raised and the body is placed almost vertically. The reason why the horizontal posture is the easiest in narrowing of the pulmonary artery is, that the distress of breathing results from the insufficient access of blood to the lungs; and hence the recumbent position not only affords the aid of gravitation to the contractile efforts of the heart, but also renders the supply of arterial blood to the brain more free than it could otherwise be. The other symptoms of some impediment to the passage of blood through the pulmonary artery are,—a superficial systolic murmur, which is heard in the course of the vessel, and over the base of the right ventricle; an habitually small, rapid, regular pulse, usually with excessive action of the
heart; together with a livid hue of the surface, where the obstruction is considerable.

The remaining morbid conditions of this vessel are,—dilatation which generally follows hypertrophy of the right ventricle, the consequence of long-standing vesicular emphysema; ulceration, owing generally to the pressure exerted by an aneurismal tumour of the arch of the aorta; and rupture, either as the result of mechanical injury, or of a degeneration of the coats of the vessel. The occurrence of aneurism in this vessel has been rarely observed. According to Dr. Chevers, the great dilatability of the ascending portion of the artery appears to be the principal cause of its immunity from this lesion; while its internal branches are still further protected by the elastic support afforded by the lung tissue. Sometimes, doubtless, an aneurism has been present, but it has been overlooked, and many cases are on record in which an aneurism has formed in cases of tubercular phthisis, the rupture of the sac producing fatal hæmoptysis.
PART VI.

DISEASES OF THE THORACIC WALLS.

I. PLEURODYния.

Pleurodynia [from Πλευρα = the side + ὀθήνη = pain], or chronic rheumatism of the walls of the chest, is a disorder of almost everyday occurrence. It is of importance on account of the long-continued pain to which it often gives rise; and partly because it is always believed by the patient to be an inflammation of the side, while every now and then it is mistaken by the practitioner for pleurisy or pericarditis, or even for peritonitis.

This affection is sometimes associated with rheumatism of the joints, but in by far the greater number of cases there is no such combination. In nineteen cases out of twenty, the muscular and fibrous textures of the left side of the chest are alone affected. The pain may be acute, and it often comes on suddenly; being referred to the infra-mammary region (though sometimes it extends rather lower), and being increased by a deep inspiration or by any stretching movement of the trunk.

The diagnosis is easy with moderate care; for although there is often tenderness on pressure, with slightly impaired thoracic movement, yet there are none of the physical signs of pleurisy, &c. The pulse also does not betoken inflammation; while the tongue is clean, the skin inclined to be cool rather than unduly hot, and there is no ree dyspnœa. Out of the large number of cases which I have seen, I can recollect none where the general symptoms have not been those of impaired health, with debility; there usually being found, moreover, more or less constipation, loss of appetite, mental depression, and the secretion of urine containing an excess of phosphates or urates. One of the worst examples of pleurodynia which I have met with occurred in a medical man who was suffering from acute rheumatism affecting the knees and ankles; and I well remember the incredulity with which he received my opinion that his pericardium was healthy, as well as the difficulty that was experienced in preventing him from taking calomel and having a vein opened. The success which followed the use of simple treatment, however, quite re-
assured him.—In tertiary syphilis there is often pain about the middle of the sternum, and sometimes costal periostitis; but a consideration of the general symptoms, together with a local examination, will prevent this disease from being mistaken for pleurodynia.—In herpes zoster or the shingles, sharp pain often precedes the appearance of the vesicles; but the suffering is usually of a burning character, and is not increased by movement.

Pleurodynia affects men rather more frequently than women, probably because of the greater exposure of the former to the sources of rheumatism. The residents of marshy districts, the inhabitants of damp houses, coal porters and other labouring men who drink large quantities of beer, as well as policemen or soldiers on night duty, are very liable to this affection.

In the treatment of these cases, over-active remedies ought decidedly to be avoided. Cupping, leeching, severe purging or sweating, and blistering will only render the disorder more intractable. If the pain come on in the course of rheumatic fever, it may merely be necessary to order fomentations or hot poultices in addition to the remedies which are being employed. But in ordinary cases, where the pleurodynia is the sole manifestation of any disease, a cure may generally be effected in from three or four days to a fortnight, by a mixture of ammonia, tincture of aconite, and bark (F. 371); by one or two warm water or Turkish baths (F. 130); by friction night and morning with a belladonna and opium liniment (F. 281); and by plain nourishing food. Stimulants can be given, if necessary; but all kinds of beer and port wine should generally be avoided. In obstinate cases, iodide of potassium (F. 31) may be required; while cod liver oil will often prove extremely useful.

II. INTERCOSTAL NEURALGIA.

Neuralgia [from Neυρουν = a nerve + αλγος = pain] may affect the intercostal, as it does the other nerves of the body. The pain is either of a dull and continued aching character, or it comes on in sharp paroxysms; while it is most frequently situated in the sixth, seventh, eighth, or ninth nerves of the left side. These nervous trunks (anterior primary branches of the dorsal nerves) pass forwards in the intercostal spaces with the vessels, and are distributed to the parietes of the thorax and abdomen. The pains, whether dull or severe, follow the course of the nerves, and extend from the thoracic wall directly backwards to the vertebrae. One or two particularly painful spots can often be detected by pressure, while sometimes there is cutaneous hyperæsthesia of the whole mammary or infra-mammary region. There are no febrile symptoms; the pleure, lungs, and heart are found healthy; but there are often indications of debility. The catamenia are
sometimes irregular, or the flow may be supplemented by an abundant leucorrhoeal discharge. Oftentimes there is some uterine or ovarian disorder present; particularly such as retroflexion, excoriation of the labia, or chronic ovariitis.

Chlorotic and hysterical women suffer most frequently from this species of neuralgia. I have met with it during the progress of Bright's disease. It may form a subsidiary phenomenon in phthisis. The pain sometimes lasts for weeks; being got rid of with the greatest difficulty in those cases where there is no obvious condition of the general health, or no local affection, to account for it. Intercostal neuritis is the only disease with which it can be really confounded, and this is of very rare occurrence. A dull, tensionaching, referred to the left hypochondrium, is not unfrequently complained of in affections of the spleen; but the pain is seldom troublesome until the gland has become so much enlarged that it can be readily felt.

The remedies which are usually the most beneficial, consist of quinine, iron, cinchona, cod liver oil, and a nutritious diet. Friction with liniments containing belladonna and aconite gives relief. Sometimes, pressure by means of strips of belladonna plaster applied all round the thorax is a source of great comfort. Where there are one or more obstinately tender points, the subcutaneous injection of the sixth of a grain of morphia (ρ. 314) will effect a cure, if employed in conjunction with remedies that improve the general health.

III. THORACIC MYALGIA.

The tendinous insertions of the fleshy bodies of the pectoral muscles, and sometimes of the intercostal muscles, every now and then become the seats of a hot wearying pain, which is often mistaken for pleurodynia and even for more serious diseases. It is probable also that the diaphragm, like the other muscles of respiration, occasionally suffers from myalgia; especially where the ceaseless action of this septum gets exaggerated by affections attended with dyspnoea.

Myalgia [Mυς = muscle + ωγος = pain] is generally due to over-work of the affected muscles. It is a disorder common to both sexes, though probably arising most frequently in males. The pain is seldom complained of in the morning, especially after a good night's rest; but it follows upon a few hours' exertion, and gradually increases towards the evening. Patients give various accounts of the amount of suffering, and frequently the descriptions appear to be exaggerated. No doubt some individuals feel pain much more acutely than others; so that what is regarded as almost torture by one would be looked upon as trifling by another. The physical suffering, however, is not on these grounds to be
ABNORMALITIES OF THE DIAPHRAGM.

lightly thought of; and especially should the practitioner avoid the habit easily acquired, of looking upon a reputed pain as imaginary, because it is spoken of in more extravagant terms than he may think warrantable.

In all cases of persistent myalgia the blood is more or less impoverished, and consequently the general health will be found depressed. Sometimes the appetite is bad, and the digestion impaired; the bowels are constipated; attacks of palpitation are common; the sexual functions are disordered; and there is a disinclination for work of any kind. The patient also is irritable or low-spirited. From this it follows that the treatment should consist in diminishing for a time those exertions or movements which have been the partial cause of the disorder; while a certain amount of rest is to be especially ensured to the affected muscles by the application of a flannel bandage round the thorax. Friction with anodyne liniments will also be of service, but above all the general health ought to be improved by remedies to promote digestion, quinine with ferruginous tonics, and nourishing food. The use of strips of opium or belladonna plaster around the painful part of the chest often does good; the favourable result being partly due to the support afforded to the muscles, and partly to the soothing of their excessive irritability.

IV. ABNORMAL CONDITIONS OF THE DIAPHRAGM.

Considering the very important parts with which the diaphragm is in relation, it cannot appear surprising that this thin musculo-fibrous septum often gets involved in the diseases of adjoining organs and tissues. Independently of its position as a barrier between the thorax and abdomen, the diaphragm is the most important inspiratory muscle. Then, its upper or thoracic surface is in relation with three serous membranes—the pleura on either side, and the pericardium covering the tendinous centre; while its under or abdominal surface is closely connected with the peritoneum. Moreover, through three large openings in its coats are transmitted the aorta and thoracic duct and right azygos vein, the oesophagus and pneumogastric nerves, and the inferior vena cava. Being thus placed in such close approximation with the pleurae, lungs, and heart by its upper convex surface, it cannot but often become involved when morbid action is set up in these vital organs. So the connexion of its under concave surface with the liver, the spleen, and the left or greater extremity of the stomach; and less intimately with the kidneys, pancreas, transverse portion of the duodenum, and solar plexus must
materially tend not only to influence its action, but also to make
it a frequent secondary seat of disease.

Inflammation of the diaphragm, or diaphragmitis \(\Delta \alpha \phi \rho \alpha \gamma \mu \alpha\), a
separation between two parts, from \(\Delta \alpha \phi \rho \alpha \gamma \mu \alpha\) with the terminal
-itis\], is probably only met with by the physician when it sets in
consecutively to disease in adjoining organs. The morbid action
may possibly, however, have its starting point in a rheumatic state
of the system; none of the thoracic or abdominal viscera being
at the same time affected. As a consequence of punctured wounds,
fractured ribs, and other mechanical injuries, diaphragmitis is
every now and then observed in hospital practice.

The chief symptoms of this disease are those presented in
other important inflammations; supplemented by the occurrence
of severe tenderness with a sense of constriction around the upper
part of the abdomen and back, great pain about the sternum and
lower ribs on coughing or sneezing or making a deep inspiration,
more or less dyspnea, the performance of the respiratory move-
ments almost wholly by the intercostal muscles, painful deglut-
tion, anxiety of countenance, frequent hiccup and sobbing, spasms
or cramps of all the abdominal muscles, and perhaps a sense of
suffocation with delirium. Where, in fatal cases, an opportunity has
been afforded of ascertaining the effects of the inflammatory action,
the results which have for the most part been observed have con-
sisted of effusions of coagulable lymph or of a sero-albuminous fluid,
or of patches of ulceration, or of small collections of pus. When
recovery has happened and examinations have been made after
the lapse of years, the diaphragm has been seen to have be-
come abnormally adherent to neighbouring viscera; while it has
also perhaps been found considerably thickened, with its tissue
rendered almost as dense as cartilage.

The treatment should be of the same character as that required
in inflammations of the organs connected with this muscle. Belts
of linseed poultice, made very hot and moist, and medicated with the
extracts of belladonna and poppies (F. 297) are especially service-
able. Vomiting is to be averted by the use of ice. The inhalation
of chloroform and ether (F. 313) will often relieve the hiccups when
all other remedies fail. The persistence of pain at any one point
can be stopped by the use of the ether spray, or by subcutaneous
injections of morphia and atropine (F. 314). The importance of
milk as an article of nourishment is not to be overlooked.

Fatty degeneration of the diaphragm is a morbid state which is
probably more common than at first sight the practitioner will feel
inclined to believe. The affection, however, has been overlooked;
and chiefly for the reason that in a large number of post mortem
examinations the condition of this septum still escapes investiga-
tion. So far as I can call to mind, Mr. G. W. Callender has been
the first to notice this disease.* Here and there cases have been reported where the diaphragm has been discovered wasted in connexion with a similar affection of the other muscles of the body. But in the widely different instances published by Mr. Callender, the tissue of the diaphragm has been found to have undergone conversion into fat; the granules of which have destroyed and taken the place of the muscular fibres. For the most part, this degeneration has been met with in connexion with a similar change in the muscular structure of the heart; so that sometimes death has occurred from a failure of the action of this organ, sometimes from severe disturbance and embarrassment of the breathing owing to the insibility of the spoiled and fatty diaphragm to contract properly and to allow of normal inspiration. Now and then not only the structure of the heart and diaphragm is more or less destroyed by fatty degeneration, but other muscles, with the liver, and coats of the bloodvessels, are injured in a similar way. In such, death may of course happen in one of several ways, from exhaustion, from syncope, from rupture of the heart, from cerebral hemorrhage owing to the coats of a vessel giving way, or from the breathing becoming laboured to a degree incompatible with life. The question as to which organ shall first give way, will probably be determined by accident; that which becomes over-strained or excited being the one to yield.

Cancer of the diaphragm as a primary disease is unknown. Cancerous infiltration or deposit, the consequence of the extension of malignant disease from the liver or oesophagus or other adjoining organs, is not very uncommon. Under these circumstances, one or more large masses of cancer will perhaps be found, on the under or upper surface of the diaphragm; or there may be merely a number of papulae, with small patches or laminae formed by the coalescence of several of these pimpls. Moreover, isolated cancers have been observed in this structure; that is to say, cancer of the diaphragm may be the only disease detected at the necroscopy, the original mischief having been removed some time previously by operation. This appears to have been so in a case related by Sir Robert Carswell; in which several nodules varying in diameter from a pea to half-a-crown, and formed of a scirrhous stroma with a milky-looking infiltration, were discovered in the diaphragm of a woman who had previously had her breast amputated.

Syphilitic gummous tumours have been found in the diaphragm; these growths oftentimes extending upwards into the lung, in other instances downwards into the liver. Now and then, both the lung and liver are firmly adherent to the gummous mass. In a woman who died at the Middlesex Hospital, in November, 1867, of syphi-

lithic disease of the dura mater and liver, there was found a firm and pale-yellow tumour with whose septa running through it, the size of half a large orange, embedded in the substance of the diaphragm. The growth projected downwards, and was inseparably connected with the left lobe of the liver, as well as with the spleen. I know of no means by which such a morbid condition could be detected during life.

Laceration or perforation of the diaphragm has occurred from falls and other accidents; from attempts to suppress the pains of parturition; and from violent vomiting. It has also taken place in consequence of the extension of suppuration and ulceration from the liver, spleen, or even stomach; from the rupture of an aortic aneurism which had encroached on its texture; from malignant degeneration; from the extension of hydatid cysts upwards from the liver, or downwards from the lungs; as well as from some congenital malformation or cleft becoming unusually strained and so giving way at its border. When the diaphragm is ruptured, there is usually hernia of abdominal viscera into the chest.

Paralysis of the diaphragm is a rare occurrence, but it is sometimes left after an attack of pneumonia, or pleuro-pneumonia, or it may have no obvious cause. Injury to both phrenic nerves or their implication in a tumour may give rise to it. The symptoms are extreme frequency of respiration and disproportionate movements of the ribs to compensate for the deficient expansion of the lungs. The characteristic feature, however, is the flapping to and fro of the abdomen, which is drawn in during inspiration and forced out in expiration, following of course the movements of the diaphragm, which instead of contracting and descending during inspiration is carried upwards by atmospheric pressure. Another effect is great feebleness of the voice in consequence of the impossibility of giving adequate tension to the air in the chest.

Finally, convulsive action of the diaphragm, or spasms of the midriff, may prove troublesome as a mild idiopathic affection, or as a consequence of irritation from morbid action going on in adjoining tissues, or as a result of general exhaustion from disease in distant organs. Hiccup is a curious effect of the sudden and involuntary and momentary contraction of the diaphragm, the glottis being simultaneously narrowed. In vomiting, crying, sobbing, sneezing, &c., there is convulsive action of the midriff; the other muscles of respiration being likewise affected. Moreover, in weakly subjects long-continued attacks of hiccup or vomiting, of chronic cough, of dyspnea, &c., may lead to diaphragmatic myalgia; a painful affection which has been referred to in a preceding section.
PART VII.

DISEASES OF BLOOD-VESSELS AND LYMPHATICS.

I. ARTERITIS.

Arteritis, or inflammation of the arteries, is very rare in an acute form, except as a result of injury or surgical operation, such as ligature or division in amputation, when it is local and reparative. Occasionally, however, in unhealthy conditions of system a diffuse arteritis occurs giving rise to acute burning pain in the parts supplied, with tenderness along the course of the vessel, and ultimately gangrene may result, though this is extremely rare.

Chronic arteritis is much more common, especially in the larger vessels, since atheroma (endarteritis deformans), formerly considered to be purely degenerative, is now known to be inflammatory. One of the chief causes is overstrain upon the vessels, either from the habits and occupation of the individual, or from resistance to the passage of the blood through the capillaries and minute arteries as in Bright’s disease, gout, &c. Exudation takes place in the inner coat in patches, giving rise to smooth elevations on the interior of the vessel of an opaque yellowish-white appearance. Subsequently degeneration of the effused matter takes place, and it may liquefy and burst through into the vessel, or may become calcified. These changes do not give rise to marked symptoms, but the impairment of elasticity induced when the condition is extensive may sometimes be recognised by the sphygmograph.

II. PHLEBITIS.

Phlebitis [from Φλης, φλεβος = a vein; terminal -itis], or inflammation of the veins, depends upon, or is generally accompanied by, disease of the blood. Mr. Henry Lee has distinctly shown that the lining membrane of veins has a very slight tendency to inflammation; that the morbid action is much less mischievous than it used to be considered, unless it be accompanied
by the admixture of decomposing fluids with the blood; and that the internal coat when inflamed does not exude lymph as a serous membrane does. Indeed it is now well known, from recent experiments and observation, that the doctrines of the effusion of lymph from the lining membrane of veins; and the formation of pus by the same, are quite untenable. As Virchow has proved, the history of the affections of veins to which the term phlebitis has been hitherto applied, is really the history of the coagula (thrombi) formed within them, and of the metamorphoses through which these coagula pass.

The symptoms of phlebitis are,—pain which is increased on pressure, swelling, stiffness, and reduces in the course of the vessel generally spreading upwards towards the heart. When suppuration results, it is usually accompanied, or perhaps preceded, by rigors and flying pains in various parts of the body. The constitutional disturbance is always great. The result of the admixture of pus or other morbid fluid with blood is to cause the latter to coagulate: in this way a vein sometimes becomes filled with a coagulum; when, if the morbid matter is of such a nature that it ought to be eliminated, the connective tissue around inflames, suppuration and abscess follow, the coats of the vein ulcerate, and the contained clot is discharged by means of the abscess. On the other hand, where the poison does not produce coagulation it mixes with the circulating blood, affects the whole system, and is subsequently deposited in distant parts—as in the lungs, liver, spleen, eye, joints, areolar tissue, &c. Under these circumstances, the consequences are always very serious.

The treatment consists in employing rest, fomentations and poultices, and purgatives. When the system is low, stimulants and tonics will be necessary; especially good beef-tea, port wine or brandy, ammonia and bark, and opiates to relieve the restlessness.

Phlebolites [from Φλεψ = a vein + λίθος = a stone] are occasionally met with in the veins; and as they generally lie in dilatations, they do not obstruct the flow of blood. These bodies vary in size from that of a millet seed to that of a pea. There may be only one or two calculi, or a dozen or more. They are chiefly composed of phosphate of lime, carbonate of lime, and animal matter. Phlebolites are probably formed by calcareous deposits from the blood, thrown around a small coagulum; as hepatic calculi are produced by depositions from the bile upon fragments of cholesterine.

One or more of the large veins have been found compressed by syphilitic gummosus substance deposited around the coats. In such cases, other evidence of the cause of the disease, confirmatory of the diagnosis of syphiloma, has been present. The amount of venous distension and swelling beyond the seat of pressure will
of course depend on the extent to which the passage of blood through the affected vessel is obstructed. Unless the complications are of such a nature as to preclude all hope of recovery, treatment by large doses of iodide of potassium and bark, or by chlorate of potash and steel, should be adopted.

III. AIR IN THE VEINS.

The very great danger which results from the entrance of an appreciable quantity of air into a vein during a surgical operation has long been recognised. The important bearings of this subject, however, on the practice of obstetrics, as well as on the treatment of uterine diseases, have been less appreciated; though they are deserving of very serious attention.

The characteristic symptoms of the occurrence of this accident during an operation upon the breast, neck, shoulder, or axilla are the following:—Suddenly, while all seems going on well, a hissing, or gurgling, or bubbling sucking noise is heard; the countenance becomes pallid or livid, and sometimes intensely red at a later period; the pulse gets nearly or quite imperceptible, and the respiration laboured; while perhaps there sets in violent and irregular action of the heart. The patient when not under the influence of an anaesthetic, complains of extreme faintness and oppression of the chest, or perhaps has merely time to exclaim "I am dying;" and death often follows very quickly, perhaps with a convulsion, but frequently without a struggle. In the greater number of fatal cases, the autopsy has revealed the presence of air in the right cavities of the heart, the air being free, or mingled with the blood which is thus rendered frothy; while sometimes bubbles of air have also been found in the larger veins, as well as in the branches of the pulmonary vessels. The cause of death is the mechanical interference of the air with the action of the heart, and the difficulty of forcing frothy blood through pulmonary capillaries; severe syncope ensuing, owing to the deficient supply of blood to the brain. The warning symptom is the hissing noise, and directly it is heard the surgeon should compress the wounded vein, so as to prevent the further ingress of air. The patient ought then to be placed in the recumbent posture; ammonia is to be held to the nose, while brandy is administered by the stomach or rectum; artificial respiration is to be perseveringly and steadily employed; while the extremities may be rubbed upwards, so as to force on the circulation towards the brain. In very severe cases, the application of galvanism to the thoracic muscles must be tried. When death has happened, the quantity of air which has entered the heart has been considerable; the amount having probably been small in those instances where the dangerous symptoms have passed off and recovery has ensued.
When the air enters the circulation through the uterine veins, the symptoms are as well marked as in the surgical cases. Attention seems to have been first directed to this occurrence by Legallois, in 1829; who, while watching a rabbit that had had two successive inversions of the uterus after parturition, noticed that she suddenly struggled convulsively and died in less than three minutes. The right auricle was found full of air bubbles, while air was also discovered in the pulmonary artery, vena cava, &c. This eminent physiologist also observed the same occurrence in two other animals; and Olivier in remarking upon these facts asks,—"Is it to a cause of this kind that we ought to attribute the sudden and unexpected death in women lately delivered, and where the autopsy has disclosed nothing which could account for such a catastrophe?"*—In 1844, Professor Simpson saw a patient who had been delivered of twins an hour or two previously. There was haemorrhage, with alternate contractions and relaxations of the uterus; she had a very weak and rapid and almost imperceptible pulse, with an extremely anxious countenance; while here and there was an evanescent scarlatinoid rash over the surface of the body. A few hours after death, the abdominal contents were exposed under water; the uterine and hypogastric veins and lower vena cava being found full of frothy blood, the air bubbling up through the water when these tubes were opened.†—In 1850, Dr. Cormack read a paper on the entrance of air by the uterine veins before the Westminster Medical Society; in which he showed, amongst other points, that the communication between the cavity of the womb and the current of blood in the inferior vena cava is direct and easy, so that air once introduced into the uterine veins must soon be carried to the right auricle; there, if in sufficient quantity, to cause frothing of the blood, aeriform dis- tension of the right side of the heart, obstruction of the pulmonary artery, and congestion of the pulmonary capillaries.‡—And then, in 1857, Dr. George May, of Reading, collected the histories of eleven cases, in which death during or soon after labour had been more or less sudden, owing, as he believed, to the entrance of air through the uterine veins. In one of the cases which Dr. May saw himself, the labour had been natural and the patient had resumed her duties; when, on the eighth day after delivery, she was taken suddenly ill and expired. On the following day, frothy blood was seen on slicing the liver, there was air in the inferior vena cava and in the vena portae, and the right side of the heart was distended with frothy blood.§

‡ London Journal of Medicine, vol. ii. for the year 1850, pp. 589 and 928.
PHLEGMASIA DOLENS.

Again, not only has the entrance of air through the uterine veins caused death at the time of labour, but it has likewise proved fatal in disease. Thus, Professor Oppolzer has related an instance of uterine carcinoma, in the course of which air entered the circulation spontaneously, and caused death in about twenty-four hours.

The treatment of these cases must be conducted on the same principles as guide the surgeon when air enters a vein during an operation. Unfortunately, however, there is greater difficulty in following out the indications. Thus, to prevent the further ingress of air we can only plug the vagina—an operation which cannot be performed in a few seconds. Still, stimulants may be administered, and artificial respiration had recourse to; while warmth can be applied to the extremities, cold water dashed over the face and chest, and the patient kept absolutely quiet in the recumbent posture.

IV. PHLEGMASIA DOLENS.

Phlegmasia dolens [from φλεγματικός to burn: dolos = to be in pain], milk-leg, or white-swelling, may be defined as a brawny, non-oedematous, painful swelling of the extremities, usually the lower, attended with depression of the vital powers. It probably depends upon the spontaneous coagulation of blood in the veins; the coagulation being due to the reception within these vessels of some poisonous or acrimonious fluid, or occasionally to pressure, or merely to a cachectic state of the system. The disease commences for the most part, and especially in puerperal women, in the uterine branches of the hypogastric veins, extending thence to the iliac and femoral veins. It has been termed obstructive phlebitis, by those who contend for its inflammatory origin. It is most likely that the lymphatics are also involved, and that they become obstructed.

Phlegmasia dolens is very common after parturition, especially in women who have been much weakened by flooding, or other causes; while it is rarely met with after first labours. It also occurs not unfrequently towards the termination of uterine cancer, and in the arm in mammary cancer. The left leg is said to be more frequently attacked than the right.

Symptoms.—The disease commences generally, in from one to five weeks after labour, with fever, headache, thirst, nausea, and pain. Sometimes it begins with a chill or rigor. At the end of twenty-four or thirty-six hours, there is swelling, with loss of motor power in one of the lower extremities (both limbs are very seldom affected); the swelling often commencing about the foot or lower part of the leg and extending upwards, though sometimes it begins at the upper part of the thigh and proceeds downwards.
The limb is unnaturally hot, tender, not œdematous, but swollen perhaps to twice its natural size; it is of a pale white colour, and is tense and elastic; while it has also a glazed or shining appearance. The acute stage generally lasts about fourteen or twenty-one days; but the limb frequently remains swollen and feeble, or almost useless, for many weeks or even months.

*Prognosis.—This is generally favourable, the disease very rarely proving fatal. As the general health is improved, the swelling and tenderness decrease; although some uneasiness, with diminished power and sensibility of the limb, may continue for a few months. When a woman has once suffered from phlegmasia dolens after parturition, great care should be taken to maintain her health during subsequent pregnancies and labours.

Pathology.—Dr. Mackenzie rejected the opinion that this disease arises from phlebitis. He believed that it is due to a vitiated state of the blood, giving rise to irritation of the nerves, muscles, lymphatics, lining membrane of veins, and areolar tissue of the limb; owing to which there result the tense elastic swelling, pain, loss of the power of motion, affection of the lymphatics, and obstructed condition of the veins, constituting the pathognomonic symptoms. Hence, this gentleman asserted that phlegmasia dolens is a blood disease, the affection of the veins being of secondary importance since it is merely an effect of the disorder.* Dr. Robert Lee (in a paper published in the same volume as Dr. Mackenzie's) gives the results of his last twenty-four years' experience. His cases, he says, "prove in the most conclusive manner that inflammation of the iliac and femoral veins is the proximate cause of the disease; and that in puerperal women, the inflammation commences in the uterine branches of the hypogastric veins. It has likewise been demonstrated by morbid anatomy, that phlegmasia dolens is a disease which may take place in women who have never been pregnant, and in the male sex, and that, under all circumstances, the proximate cause is the same.".

A later writer on this disease is Dr. Tilbury Fox, whose essay is well deserving of careful study.† I can only give this gentleman's conclusions, which are as follows:—In phlegmasia dolens both veins and lymphatics are obstructed. The obstruction may either be due simply to extrinsic pressure; or to inflammatory changes in the coats of the vessels leading to coagulation (this depends upon virus action), which except during epidemics of puerperal fever is not so common as is supposed. It being generally admitted that rapid ingress of abnormal fluid suddenly, and in large amount, will cause instantaneous coagulation of blood; and it being also allowed that large drains from the system are followed by rapid and compensatory absorption;—there is good

reason for believing that these conditions are amply fulfilled, in conjunction with the presence of wound (facilitating absorption) in a great many cases, prior to the occurrence of phlegmasia dolens, and that the latter is frequently thus evolved. These different modes of evolution may be more or less conjoined.

Treatment.—Dr. David Davis, who paid much attention to this affection, recommended the local abstraction of blood by leeches, the application of blisters, the use of evaporating lotions, free and constant exposure to the action of the atmosphere, and the internal exhibition of digitalis with blue pill.—Dr. R. Lee seems to place most reliance on the repeated application of leeches above and below Poupart's ligament.—In the cases which have been under my own observation, the patients have invariably been in a feeble state of health, and consequently such remedies as venesection, leeches, calomel, and digitalis have not been thought of. I have generally at first employed sedative and alkaline fomentations, perfect rest, simple diet, and opiates to relieve the pain. The fluid in which the fomentation flannels are to be wrung out is made by adding one pound of bicarbonate of soda, and one ounce of extract of poppies, to each gallon of boiling water. The flannels ought to be changed every thirty minutes; they are to be applied over the whole limb, and even over the groin and lower part of the abdomen if there be tenderness; while the heat and steam from them are to be retained by the use of impermeable cloth. At a later stage, great benefit has seemed to accrue from attempts to improve the condition of the blood; as by the use of wine, brandy, milk and raw eggs, animal food, ammonia and bark, &c. Where there has been any offensive vaginal discharge, injections of simple warm water, or of some weak disinfectant solution, have been used every night and morning.

Flying blisters and stimulating liniments to the limb, are now and then useful when all the acute symptoms have subsided; but I have found nothing answer so well as efficient bandaging. At this stage also I have seen much good from the employment of the iodide of iron, or of the chlorate of potash and bark; as well as from quinine, cod liver oil, and temporary change of residence to the seaside.

V. INFLAMMATION OF THE LYMPHATICS.

The absorbent or the lymphatic [Lympha = water] system includes the superficial and deep lymphatic vessels, the glands through which these ramify, and the lymphatics of the small intestines—the extremely delicate lacteal or chyliferous tubes. The lymphatic vessels are distributed through almost every vascular organ and tissue in the body. In the brain and spinal cord they take the form of perivasculaer canals or sheaths, but the membranes of
these nervous centres are supplied with them. The lymphatic or absorbent glands are found in the neck, axilla, front of the elbow, groin, and popliteal space; in the thorax, about the anterior and posterior mediastina; and in considerable numbers in the abdomen—in the mesentery, as well as by the side of the aorta, vena cava, and iliac vessels.

Inflammation of the lymphatic vessels, or angeiodelenitis [from ἀγαγεῖν = a vase or vessel; λεύκωσις = white; terminal ὀίτις], may result from external injury, or from the absorption of some deleterious matter. The vessels are seldom, if ever, attacked without the glands being involved in the morbid action; though the glands occasionally become inflamed while the vessels remain healthy.

The best examples of angeiodelenitis are seen in the case of punctured dissection wounds with the absorption of corrupting animal matter; in carbuncles and abscesses, from the absorption of unhealthy pus; and in accidents where the consequent inflammation assumes an erysipelas character. The course of the inflammation is shown by the formation of bright red streaks, which run upwards from the wound in the direction of the absorbents, along the previously healthy surface as far as the glands in which the vessels are merged; these streaks or lines being tender to the touch and hard like little cords, while they are the seat of stinging burning pains. The glands in connexion with the affected vessels quickly become involved, and get swollen and acutely painful; while the whole limb is rendered more or less puffy and tender. The constitutional disturbance is always great; there being in many instances chills or rigors, nausea and constipation, fever, prostration, restlessness, and considerable mental depression. The inflammation will either terminate in resolution; or it may end in suppuration, with the formation of large abscesses, or with infiltration of matter around the lymphatics and ganglia; or it may pass into a chronic stage, causing induration which will probably remain for months; or it may actually lead to fatal exhaustion, or to death from ichorhæmia. Not unfrequently also, inflammation of the lymphatics becomes complicated with erysipelas, or with phlebitis, or even with both.

The remedies for this affection are few, but they require to be promptly employed. Any wound which may be present should be bathed and poulticed, while the whole limb is to be assiduously fomented. Considerable relief will be afforded by freely painting the inflamed lines with extract of belladonna, or with belladonna and extract of poppies (F. 297), before applying the fomentation flannels. Care is to be taken that the air of the sick-room is pure and cool. The patient is to be abundantly supplied with refreshing drinks, or he may be allowed plenty of ice. The diet is to consist of milk, and strong beef tea; while the depression which early sets in is to be combated by the administration of wine or
brandy. The bowels are to be cleared out by a dose of jalap, or by stimulating enemata. Then, no drug, as a general rule, proves so useful as the carbonate of ammonia; which may be given in oft-repeated doses, with bark or some bitter infusion (F. 371). When urgent typhoid symptoms, with clammy sweats and delirium, set in, care must be taken that the blood is not overcharged with ammonia; but if it be so, the hydrochloric acid (F. 357) ought to be prescribed, while brandy is to be administered at short intervals. If suppuration, either diffused or circumscribed, take place, the pus must be evacuated by free incisions.

VI. INFLAMMATION OF THE LYMPHATIC GLANDS.

Inflammation of the lymphatic glands, or adenitis [from Aden — a gland; terminal —itis], is not only an accompaniment of angine-leucitis, but it may occur independently of such an affection. Thus, in children recovering from one of the eruptive fevers, particularly scarlatina, the cervical glands are apt to become swollen and tender, the inflammation not unfrequently ending in suppuration. Again, in strumous subjects adenitis is a very common disorder; though in such the inflammation is by no means always of a simple character, being often due to the insidious deposition of tubercle in the gland.

The commencement of acute adenitis is often indicated by a feeling of malaise, followed by slight chills and symptomatic fever. Then, one or more glands become swollen, hot, hard, tender, and painful; the swelling being chiefly due to infiltration of the areolar or connective tissue of the gland. As the tumefaction increases, the skin over it becomes reddened or livid; while if the convoluted tubes get obstructed, the surrounding tissues will be rendered oedematus. Unless resolution occur, or unless the acute symptoms gradually subside into chronic inflammation, there will be suppuration in a few days; an abscess forming in the interior of the gland, or in the connective tissue which surrounds it. The latter event is not uncommon; and it may be recognised by finding that the tumour is no longer circumscribed and moveable, as it remains when the pus forms only in the interior of the gland. — In cases where the morbid action is chronic or subacute from the commencement, or where the acute merges into the chronic form, we find induration with persistent enlargement; the pain and heat being slight, while the skin retains its natural colour, and the connective tissue remains unaffected so that the gland is moveable.

Strumous enlargement and inflammation are usually chronic; the glands of the neck, and those about the base and angle of the lower jaw being more frequently affected than any others. The subjects of this form are especially young children, though it is
not a rare affection of delicate adults—of such as manifest a strumous diathesis. There are no premonitory symptoms, as a rule; the first indication of the disease being a swelling of one or more glands. If the mischief increase, however, and especially if there be a tendency to suppuration, the system will suffer considerably; and the already weakened patient becomes irritable and restless, his tongue gets furred, his pulse is tendered quick and feeble, the bowels become costive, the appetite fails, while the urine will be found scanty and loaded with urates. Where the general health is very bad, the inflamed glands rapidly undergo disorganization; and the surrounding connective tissue and skin getting involved, extensive indolent ulcers result. When the lymphatic glands of the mesentery are affected with strumous inflammation, a special and often fatal form of disease is set up which will be described in a subsequent section.

The treatment of simple acute adenitis is much the same as that required for angioneuritis. In the strumous variety we have especially to improve the general health; and consequently such remedies as quinine and iron (F. 380), iodide of ammonium and bark (F. 38), the so-called chemical food (F. 405), and cod liver oil are all valuable remedies. The diet must be nourishing, with a full allowance of milk; while no treatment will be of permanent advantage unless the patient has the benefit of pure air. Local applications are of comparatively little value; but in the early stages of the inflammation water dressing soothes the irritable glands better than poultices. If there be much pain the application of belladonna and extract of poppies (F. 297) in combination with bread and water poultices, affords great relief. When the inflammatory action, however, has subsided, and the glands merely remain indurated, the application of iodine, or friction with the red iodoide of mercury ointment diluted with lard will often produce absorption. Injection of iodine into the substance of such glands has also proved successful, and an indolent glandular abscess may be emptied by the aspirator. As a rule, enlarged glands are not to be extirpated.

The nature and treatment of adenitis of a venereal origin has already been described. It is also unnecessary to speak here of the affections of these glands from cancerous infiltration; such disease being much more commonly a secondary than a primary formation.

VII. DILATATION OF THE LYMPHATICS.

A partially hypertrophied and varicose state of the lymphatic vessels has been observed by many authors. The dilatation is sometimes congenital; or it may be due to some obstruction of the convoluted tubes in the glands; or it will have arisen from the
pressure of an aneurisma or other tumour on the trunks in which the vessels terminate.

Dr. Carswell mentions the remarkable case of a young man about twenty-six years of age, who was seized with severe abdominal pains and vomiting. There was a swelling in each groin, nearly as large as an orange, and the cause of suffering was therefore attributed to strangulated hernia. Owing to the great prostration, no operation could be attempted. After death, the only remarkable circumstance observed was enormous dilatation of the lymphatics from both groins upwards, including the thoracic duct. The two swellings in the groins, which had actually been treated as double herniae, a truss having been worn from boyhood, were found to be produced by great dilatation of the lymphatics of the inguinal glands. As no obstacle could be detected throughout the course, or at the termination, of the thoracic duct to account for the dilatation of the lymphatics, it was concluded that the condition was a congenital malformation.*

Dr. Grainger Stewart has recorded the history of a man who died at the age of sixty from heart disease. On examining the small intestine, a number of whitish-yellow patches were seen, varying in size from that of a pin head to that of a small bean, scattered throughout its coats. Some of these patches were quite granular on the surface, and evidently connected with the mucous membrane; others were smooth, rounded, and lobulated like minute fatty tumours, and evidently lay in the submucous layer, for by a little careful dissection they could be separated from the mucous membrane on the one side, and from the muscular layer on the other; while a third set, again, much less abundant, consisted of a combination of the other two. On microscopic examination, those of the first kind were found to be made up of groups of villi greatly distended as in the process of digestion—i.e., they were dark and opaque. On tearing them, a milk-like fluid escaped which presented microscopically the characters of milk or chyle. The villus then collapsed, and there was no appearance of the bloodvessels having been distended; wherefore it seemed obvious that the whole enlargements depended upon the presence of the milk-like fluid. Those of the second kind resembled small fatty tumours, and were situated between the mucous and muscular coats. Some consisted of a single lobule, others of several lobules. On pricking any of them, a milk-like fluid containing aggregations of fatty granules flowed out, and the walls of the particular lobule collapsed.—Dr. Stewart also quotes a corresponding case from Rokitansky, the chief features in which were these:—The body of a man, who died at the age of sixty-two, presented oedema of the subcutaneous areolar tissue, and very considerable effusion of a milk-like fluid, in both the pleural and peritoneal cavities; dilatation

and hypertrophy of the heart, with thickening and shortening of the mitral valves; thickening of the mucous membrane of the stomach in the pyloric half, and a white and swollen condition of the intestinal walls; while the subpleural lymphatic vessels were distended, and still more the chyle vessels and the thoracic duct. They presented, from the bowel to the first series of lymphatic glands, knot-like dilatations, full of a white soapy or greasy-looking matter, which became diffused in water. It consisted of fatty granules, crystals of margarin, and some apparently nucleated cells. The lymphatic glands contained similar small deposits, and in the thoracic duct there were some dilatations.*

Dilatation of the lymphatics appears occasionally to lead to a rupture of their coats, in the same way that varicose veins sometimes give way. Dr. W. H. Day has recorded such a case, the rupture occurring in the inguinal region, with profuse discharge of a milky fluid. Dr. Carter's cases of chylous urine, in which there was probably a leakage from the lacteals into some part of the urinary track, have been already referred to. The same gentleman has also published certain facts, which appear to indicate a close connexion between a varicose state of the lymphatic system and elephantiasis Arabum attacking the scrotum.†

VIII. TABES MESENTERICA.

Tabes Mesenterica [Tabes = a consumption, from tabeo = to melt away: Μεσεντιρίῳ = the membrane which connects the intestines together,—μέσος, ἔντερον] is the name given to a tubercular or sebaceous degeneration of the mesenteric glands. The disease might appropriately be termed abdominal phthisis.

To understand the pathology of mesenteric disease it is necessary to remember that the tubercular matter becomes effused into the glands themselves, more or less destroying their structure, and of course preventing the passage of the chyle through the lacteals which traverse them. Consequently there is impaired nutrition, varying in grade according to the extent of lymphatic obstruction. The glands are found enlarged, and affected in different degrees; in some the abnormal product being tough and almost fibrous, in others degeneration having so far advanced that it is soft and pulpy, while in a third class there is only a calcareous deposit owing to the albuminous portion having been absorbed. Mesenteric disease particularly affects infants and young children; but it is by no means as frequent as the old authors believed, who regarded every child with a swollen belly as a victim of it.

The symptoms indicative of tabes mesenterica are chiefly the following:—There is pain in the bowels, more or less constant and sometimes severe, causing the child to keep his legs drawn up towards his belly. The lips are of a deep red colour; and the angles of the mouth are covered with small ulcers, or the whole lip is fissured. The bowels are variable, though generally relaxed; the motions being often unhealthy, and extremely fetid. The abdomen is swollen, tense, and the parietes have a peculiar hardness; while the other parts of the body waste away, owing to the obstruction of the chyle ducts, until an extreme degree of emaciation exists. There is great pallor and general debility: the weakness increases very rapidly. Symptoms of pulmonary consumption may supervene, or the brain may become implicated, or the child may die worn out by the abdominal disease. Recovery does sometimes occur, however, when treatment is resorted to before the functions of the glands are much impeded. In these favourable cases the period of convalescence will be very slow, and great caution must be employed to prevent any relapse.

The diagnosis is not always very easy, and there are two or three disorders with which this disease is apt to be confounded. Thus, strumous infants not unfrequently suffer from very obstinate diarrhoea, as a sequela of some exhausting disease; or a looseness comes on owing to insufficient nourishment, or to the child being kept in a damp offensive atmosphere, &c. The evacuations also are not only very numerous, but unhealthy; consisting of greenish mucus, with undigested food. The countenance becomes anxious and aged; the skin is found to be harsh, the breath offensive, the tongue dry and aphthous, and the stomach irritable. Moreover, the little patient is restless and very fretful. If removal of the cause, and the use of such remedies as milk and lime water, logwood and opium, ipecacuanha and catechu, port wine or brandy, &c., fail to effect a cure, extreme exhaustion sets in which soon ends fatally. After death the mucous membrane of the alimentary canal will be found quite normal, while the mesenteric glands may be merely swollen and congested—probably as the consequence of the irritation, although possibly as its cause.

Again, hydrocephalus in its early stages somewhat resembles strumous disease of the abdomen. But in the former the cerebral oppression is greater, sickness is more troublesome and constant, the mind is duller, there may be strabismus, and the abdomen is found flattened rather than distended.

In tuberculization of the bronchial glands, there is greater disturbance, at an earlier period, than when the mesenteric glands are alone diseased; owing to the fact that in enlargement of the former the air tubes soon become compressed and their vital functions interfered with, the unyielding walls of the thorax offering a marked contrast to the flexible parietes of the abdomen.
The general character of the symptoms, as well as of the pathology, is the same in both cases.

Tubercular peritonitis is hardly to be distinguished from the disease under consideration, with which indeed it is often combined. Fortunately, the distinction is unimportant.

The treatment of tabes mesenterica must consist in the use of mild nourishing food adapted to the child's age and strength; asses' milk, goats' milk, soda water with milk, cream, and farinaceous preparations being very useful. Port wine and beef tea are valuable agents. Cod liver oil will be of much service in many cases; especially when given with tonics, and sometimes with small doses of iodide of potassium and the ammonio-citrate of iron (F. 31, 32, reduced in strength according to the patient's age). In several instances I have seen great benefit from the employment of "chemical food" (F. 405); as well as from small doses of the hypophosphite of soda and bark. Raw meat, mincèd very fine, is not unfrequently taken greedily by children with mesenteric disease, marked improvement resulting. Where the motions are very offensive, a few small doses of mercury and chalk combined with a grain or two of the powder of ipecacuanha and opium, or with the aromatic powder of chalk and opium, prove serviceable. Astringents to check the diarrhea, frictions over the abdomen with the common soap or opiate liniments, hot linseed poultices to relieve any pain, warm clothing, and the employment of a flannel bandage round the body will frequently be necessary. Care must also be taken that the air of the child's apartments is kept healthy; it being especially necessary that the sleeping room should be of a good size and properly ventilated.

The invigorating influence of sea air is as clearly apparent in the early stages of tabes mesenterica as it is in other forms of tuberculosis. Children who have refused both food and medicine, and who would pine and die in the unhealthy courts and narrow streets of large cities, seem to imbibe a new life with the inspiration of a pure air, loaded with saline particles. Materials which the stomach previously refused to digest, become converted into healthy chyme; the blood circulates with renewed activity through the enfeebled frame; and while nutrition becomes stimulated, the secretions from the various glands gradually appear of a more healthy character, the little patient ceases to be irritable and fretful, and the muscles lose their soft flabby feel. After a few days' residence at Margate, Broadstairs, Folkestone, Eastbourne, Brighton, Scarborough, &c., when the child is becoming acclimatized, bathing may be tried; commencing with warm salt water baths every morning, and gradually lowering their temperature until a healthy glow follows quickly upon the use of tepid water. As a rule, strumous children seldom derive any benefit from cold bathing; while a dip in the open sea often produces a greater shock than they can well bear. Moreover, to force a timid and delicate child into the water is a
piece of cruelty to which no medical practitioner should ever give his consent.

The preceding remarks show that the great aim of treatment in mesenteric disease must be to improve and fortify the constitution. All remedies which interfere with this object can only prove injurious. The use of salines, aperients, tartarated antimony, digitalis, calomel, mercurial liniments, and leeches is to be condemned; for if some of such agents inflict no positive mischief, they certainly cause the loss of valuable time. Our main reliance, in short, must be placed on food which can be easily assimilated, on cod liver oil, and on sea air.
PART VIII.

DISEASES OF THE ALIMENTARY CANAL.

I. DISEASES OF THE TONGUE.

The tongue is exposed to many sources of disease and injury. As this organ is abundantly supplied with blood by the lingual, facial, and ascending pharyngeal arteries, it follows that wounds of it are often productive of copious haemorrhage. Being highly sensitive, comparatively slight diseases of its mucous membrane, or of its muscular fibres, are commonly very painful, owing to its free supply of nerves. In each half we find the hypoglossal (motor) nerve, and two nerves of sensation—the gustatory branch of the fifth, and the lingual branch of the glosso-pharyngeal.

1. GLOSSITIS.

Inflammation of the tongue, or glossitis [from Γλῶσσα = the tongue; terminal -itis], is not a very common affection, now that mercury is seldom used so as to produce salivation. The inflammation is generally met with as an accompaniment of other diseases, rather than as an idiopathic affection. Occasionally it leads to the formation of an abscess, which may be mistaken for a tumour until the pus is evacuated.

When glossitis arises idiopathically, it gives rise to fever and mental depression and general weakness. Where it is consequent upon some other affection, great constitutional disturbance may quickly ensue. In all cases the local symptoms are the same, consisting chiefly of pain and swelling and watery discharge. The tongue is found of a deeper red than usual; while occasionally the swelling proceeds to such an extent that the cavity of the mouth is not large enough to contain the organ, and it therefore projects beyond the teeth. This condition, which often occurs very rapidly (sometimes in a few hours), is attended with urgent dyspnoea, and requires prompt treatment. Purgatives should be administered by means of enemata; followed by quinine (F. 379). Ice can be freely applied to the tongue itself with very good effect. Where the oedema is great no practice gives such speedy and certain relief as
making one or more longitudinal and free incisions along the upper surface of the organ. By such incisions a quantity of sanguinolent serum drains away, while they let out pus if the morbid action has gone on to suppuration. In the event of suffocation being threatened, owing to the enlargement of the root of the tongue, tracheotomy ought to be performed. Mr. Benjamin Bell saved a patient's life by this operation, in a case of glossitis produced by mercury.

2. ULCERS OF THE TONGUE.

There are several varieties of these ulcers; most of them being exceedingly irritating or painful, and often very difficult to heal.

The whole of the upper part of the tongue—sometimes becomes superficially ulcerated, the raw surface feeling heated and tender. Severe and long-continued disorders of the digestive organs are the chief source of this form. The ulceration can only be cured by attention to the diet, particularly forbidding the use of all alcoholic stimulants; by the employment of borax gargles, or by painting the surface frequently with the glycerine of borax; and by the administration of such remedies as bismuth, pepsine, quinine, &c.

Where there are ulcerations as the result of simple inflammation, they are usually small and superficial, without definite shape, and very sensitive. They are seated about the tip or near the frenum rather than at the sides of the organ; and they cause great annoyance in eating. They are to be healed by mild diet, antacid aperients, and the application of sulphate of copper; together with the extraction of carious stumps, or the removal of the tartar from any teeth which may be irritating the raw surfaces. Ulcers occurring after ptomaine are easily distinguished by the accompanying affection of the gums and fetor of the breath. They will be most readily cicatrized by the administration of saline purgatives; by a mixture containing chlorate of potash (F. 61); and by the use of a gargle formed of chlorate of potash and tincture of myrrh in water, or of five grains of sulphate of copper to each ounce of water.

In all cases of sore tongue the stumps of teeth should be removed, or the sharp edges of broken ones filed down if they are not extracted, while the tartar from the inner surfaces of all the teeth should be scraped off.

Syphilitic ulcers may be secondary or tertiary. The secondary ulcerations are generally superficial, and are attended with similar disease of the lips or other secondary symptoms. The ulcers appear at the sides of the tongue, are very sore, and are very intractable; while they may be best treated by the mercurial vapour bath (F. 131) every night, or by the inunction of mercurial
ointment, or by the green iodide of mercury and conium (F. 53),
together with the application of nitrate of silver, or a strong solu-
tion of bichloride of mercury. The deep tertiary syphilitic ulcers
usually commence as inelastic indurations, which slough in the
centre; the sores then becoming deep and excavated, and the
edges ragged and sloughy or thickened and hard. Their most
frequent seat is the upper and back part of the tongue, but they
are sometimes seen on the under surface at the sides. They are
accompanied by other tertiary symptoms; and consequently the
various viscera should be examined so as to make sure that no
gummata are being developed. They are generally cured—at least
for a time—by full doses of iodide of potassium (F. 31), and the
frequent use of a gargle of one drachm of the dilute nitric acid to
eight ounces of water.

The remaining forms of ulcerations are either strumous, tuber-
culous, or cancerous. They occur for the most part with other
symptoms of these affections; while the strumous and tuberculous
varieties require the general constitutional treatment proper for
these affections, especially cod liver oil and milk and sea air.

3. CANCER OF THE TONGUE.

Cancerous disease of the tongue will be of the Epithelial form,
or it may present the characters of a firm Scirrhous tumour, or it
now and then proves to be of the Medullary kind. Of whichever
nature, the disease has a tendency to run on speedily to ulceration;
a foul sloughy sore forming, with ragged everted edges, and an in-
durated base.

The three chief symptoms are,—severe pain, profuse salivation,
and the cancerous cachexia. At first the patient complains only
of a sore tongue, with pain on deglutition; but soon the suffer-
ing becomes acute and most wearing, while frequent sharp pangs
dart along the Eustachian tube to the ear. The secretion of saliva
is very abundant; the fluid either flowing almost constantly from
the mouth, or passing into the throat and causing an irritating
cough. As the ulceration extends (perhaps involving the mucous
membrane of the mouth and gums) the discharge becomes most
fetid. The cachexia is early developed; for cancer of the tongue,
like that of all the soft vascular tissues, runs a rapid course. The
nights are passed in misery; there is pain with difficulty in articu-
lation and deglutition; there are occasional attacks of hemor-
rhage; the whole tongue becomes much swollen, while it may even
slough; and cancerous deposit takes place in the sublingual and
submaxillary glands, as well as in the surrounding tissues. Some-
times the mouth becomes almost filled with an extensive ulcerated
fungus; so that suffocation may be threatened. But generally
speaking, death occurs from exhaustion.

The treatment of these cases is to be conducted so as to relieve