On the Morbid Conditions of the Aorta
in particular - Aortitis, Atheroma, Aneurism.

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Preface

In selecting "The Mortal Conditions of the Aorta" as the subject of my Inaugural Dissertation, I had intended merely to have glanced at the Pathological questions and to have entered at large upon the consideration of the diagnosis and treatment. On reading and thinking, but still more on writing upon the subject, however, I found that the former were so full of interest and importance that they could not be hurried over; and thus it is, that having set out with the intention of discussing chiefly the great questions of the diagnosis and treatment of Aortic Aneurism, I have been unable even to enter upon the consideration of them. Having given a brief sketch of the General and Minute Anatomy of the Aorta, I have next dwelt at some length on the Pathology of Arteritis, Atheros and Aneurism, and have then discussed the progress and terminations of Aneurism in the four major portions of the Aorta.

The views of Arterial Pathology which I have advanced are very different from I may say directly opposed to those which are to be met with in our English Authors and which I have heard advanced in the Sec
ture room, but I feel assured that their truth will
soon be universally acknowledged, and that they
will be found to be based upon reason and fact.
I cannot claim for them the merit of originality,
but, so far as I am aware, it is the first time
they have appeared in the English language.

16 Inverleith Row.
March 10th 1851.
It is by no means my intention to consider at length the Anatomical relations of the Aorta, or to enter into a detailed account of the minute structure of its walls, but, in discussing the various morbid changes to which this large vessel is subject, and the ultimate consequences of these changes, there are some general Anatomical facts which must be borne in mind, and to these I will advert as briefly as possible.

The Aorta, arising from the base of the left Ventricle, first describes that irregular curve, which has been termed its "Arch", and then, gaining the Spinal Column, descends by its side. It receives the names "Thoracic" and "Abdominal", as it lies in these respective cavities and, having reached the left side of the fourth lumbar vertebra, it terminates by dividing into the two Common Iliac arteries. The Ascending part of the Arch, commencing opposite the upper border of the fourth Costal Cartilage of the left side, has a gradual inclination forwards and across the sternum, till it terminates on a level with the upper border of the second Costal Cartilage of the right side. Completely enclosed in
in a prolongation of the Pericardium, this portion of the Aorta is at first deeplysituated, being covered by the origin of the Pulmonary artery, and slightly overlapped by the right Auricular appendage; but, as it ascends, it becomes more superficial, and at its upper part, is less separated from the Sternum, only by its Pericardial sheath, some cellular tissue, and the scanty remnants of the Thymus gland. It rests upon the root of the right lung, and its upper half has the Vena Cava superior on the right, and the Pulmonary Artery on the left.

The Aorta, in the Transverse portion of its arch, recrosses the Sternum from right to left, and pursues a backward direction, till it reaches the body of the second dorsal vertebra. In this course, it is concealed by the left lung, with its Pleura. It lies upon the bifurcation of the Trachea, and also, but not so directly, on the Oesophagus and Thoracic duct. Above is the left Vena Saphena, and below is the bifurcation of the Pulmonary Artery. It is from the upper border of this portion of the Aorta, that the great arterial trunks, destined for the nourishment of the head and upper extremities, spring, and it is round it, that the left inferior laryngeal nerve turns, in its circuitous course, to supply the muscles of the Larynx.

The term Descending has been given to that
part of the Arch, which lies along the left side of the third dorsal vertebra, having in front of it the left lung with its root and Pleura.

The Thoracic Aorta descends in the posterior Mediastinum, gradually inclining to the middle line, till at its passage between the crura of the diaphragm, it lies upon the bodies of the vertebrae. To the left is the left lung and Pleura, and to the right the Vena Azygos Thoracic duct and oesophagus, but this latter tube, as it approaches the Stomach, inclines forwards and to the left. In front is the root of the left lung and the Pericardium. But the relations of the Thoracic and Abdominal Aorta are not so intricate as those of the Arch, and a knowledge of these is not so necessary for our present purpose.

The coats of the Arteries have for long been described as consisting of three layers, an external, middle, and internal. This statement, sufficiently minute for all practical purposes, and substantially correct, has been made the basis of a more precise division. The Microscope, the application of which has so much increased our knowledge of Structural Anatomy, has shown that each of these tunices is in reality composed of several different structures. The External, or Cell., ulcerate coat, is found to be made up of an outer layer,
Quain's Anatomy. Vol I. p. CCXLIV.
of white fibrous tissue identical with that forming ligament and tendon, and an inner she, consisting of yellow elastic fibres, the same as those which occur in Areolar Tissue, and which compose the most part of those ligaments, which, like the ligamenta sublava, are peculiar in possessing the property of elasticity. The Middle, or Muscular Coat, is that part of the Artery, in which its vital contractibility resides. It consists of an external layer of fibres, arranged in a circular manner, and an internal layer, which run in the long axis of the vessel. The fibres in both are identical with those found in contractile, or Non Voluntary muscular tissue. They are flat, broad, and pale, present oblong nuclei; but, unlike the fibres of voluntary muscle, they have no transverse striæ. It is to the presence of numerous strata of these fibres, that the larger Arteries mainly owe the thickness of their walls. Raischel has counted forty layers in the Aorta, twenty-eight in the Carotic, and fifteen in the Subclavian. The Internal, or Serous Membrane, consists on its inner aspect of a layer of nucleated pavement epithelium, but it is often impossible to demonstrate the presence of these cells, and thus it has been thought, that in the larger vessels especially this layer may be absent. It is chiefly composed of a peculiar structure, first
Henle's Anatomic Generale, Tome I, p.41
pointed out by Henle, and named by him the "Intestinate Membrane." It is very delicate and brittle, and has a great tendency to curl up, when separated from the walls of the vessel. It presents under the Microscope, numerous oval apertures of different sizes, and also a number of longitudinal striae. Where it meets the muscular coat, it loses in a great measure its membrane structure, and presents more of a fibrous character. It is, I imagine, to these fibres especially, that many authors have applied the term "Sub-ternal cellular tissue."

The "Vasa vasorum," or nutrient vessels of the Artery, are found abundantly in the external cellular coat, where they form an oblong capillary mesh-work. Burdach has described them, as passing into the middle coat, and running parallel with its circular fibres, while Weber and others have, after most careful examination, been unable to detect them in this situation. But, however observers differ on this point, it is a fact of very great importance in a Pathological point of view, and one, in reference to the truth of which, all are agreed, that the Serous Membrane, and the longitudinal internal layer of the muscular coat, are altogether devoid of blood-vessels.
Aortitis

There are few points in Morbid Anatomy, in regard to which, such various and conflicting opinions have been held, and about which Pathologists are still so divided, as the inflammation of the Arteries, and more especially of the Aorta. From the violet and scarlet colours, which this large trunk, not unfrequently presents, Bertin and Bouillaud were led to believe, that Aortitis was by no means a rare affection. Laennec, observing that these changes had been almost uniformly found in the bodies of those, who had died of fevers, who had been long in the agony of death, or who were not made the subjects of Pathological examination, till particularization was somewhat advanced, was led to question the views of these authors. By enclosing blood in a recent and healthy Aorta, and then inserting the vessel into the abdominal cavity of the subject—by observing, as far as possible, the natural constrictions—he found, that he could produce all the various appearances, described by Bertin and Bouillaud; the extent of the discoloration varying with the amount of blood, introduced into the vessel, and the depth of the colour, with the length of the time, during which the two had been allowed to remain in contact. Having thus satisfactorily proved, that alterations of hue might be the result of mere mechanical embolism,

he with justice concluded, that, when they existed alone, they could not be regarded as a sign of arterial inflammation. He believed that, when the inner coat of an artery is found thickened and pulpy, and very easily separable, we may suspect that there has been inflammation, but that the only infallible sign, is the presence of a layer of lymph on its free surface. Hope, while coinciding generally in the views of Laennec as to this point, is of opinion that Aortitis is of much more frequent occurrence than the presence of a false membrane in the Aorta after death, as that structure must, in most cases, be washed away by the torrent of the circulation.

A few instances are on record, in which this supposed exudation was found, and specimens are to be seen in our museums, in which the Aorta was even completely blocked up by so-called coagulated lymph.” Hodgson, describing such a case, says “The internal coat of the Aorta was of a deep red colour, and a considerable effusion of lymph had taken place into its cavity. The effused lymph was intimately connected with the internal coat of the vessel, and a plug of it had extended into the left Subclavian artery, and nearly obliterated the cavity of that vessel.”

Rules have been laid down by many authors, by means of which, we are to diagnose and treat.
flammation of the Aorta, but the affection has in general been so complicated, with other morbid states, that but little reliance can be placed upon their observations. So far as I am aware, there is no case on record in which Aortitis was believed to exist during life, and the diagnosis confirmed by post-mortem appearances.

There is another variety of Arterial inflammation, first noticed by Mr. Guthrie, and which he has termed "Syphilides Arteritis". This he describes as generally originating from an injury on one of the extremities, and spreading along the inner membrane of the Arteries, till it reaches the heart. It is attended with low delirium, irritative fever, and proves almost universally fatal.

The opinions, which we have thus endeavoured to state, were held, we must remember, at a time—not very distant indeed—when Histology may be said to have had no existence at all; before the Microscope had been successfully employed to ascertain the normal structure of organs, and therefore before men were in a position, rightly to comprehend their morbid conditions. But, when the Microscope has revealed to us the fact, that the internal arterial coat possesses no blood vessels, does it not appear strange to hear of its being in a state of congestion; and when we know that the Vasa Vasorum do not penetrate beyond the circular layer of the middle
Archiv für Pathologische Anatomie und Physiologie und für Klinische Medizin. Von R. Virchow und R. Reinhart
Coat, and that they are most probably entirely confined to the cellular tunic, is it not almost incredible, that an exudation, in the strict sense of that term, should take place from these vessels, penetrate through one half of the thickness of the arterial wall, and appear on the free surface of the inner membrane? How are we left to theory alone. Actual experiment has proved that arterial inflammation does not result in discoloration of the inner membrane, or exudation of lymph upon its free surface. Corneliani made a number of very interesting experiments upon dogs, in order to elucidate this point, and Virchow, having repeated them, has drawn up the following conclusions, as the result of his own observation, and of a consideration of the facts, which have been detailed by others.

1. "An exudation on the free surface of an Artery, never exists, whether the irritation be applied externally, or internally, by Chemical, or Mechanical Stimuli."

2. "The death of the Arterial Membrane (when that exists) is due to the coagulation of blood, in the affected part."

3. "Every Chemical, or Mechanical irritant, whether applied to the outer or inner side of the vessel, produces inflammatory appearances in the outer and middle layers of the vessel wall only."

4. "The inflammatory appearances, of the outer and
Artensia. Cyclopaedia of Practical Medicine.
middle coats of arteries, are identical with the inflammatory appearances in parenchymatous organs.

Small pustules have been observed underneath the inner membrane, and the same appearances were described by Corneliani, as occurring in some of the dogs upon which he experimented. These, gradually enlarging, may ultimately burst into the current of the circulation, and give rise to those "ulcers," which have been found on the inner surface of the aorta.

We believe it to be a strong argument, in favour of the view, that arterial inflammation never gives rise, in ordinary circumstances, to "exudation" on the free surface of the inner membrane, that, when a ligature is applied to an artery, if it either be too coarse, or if it be not drawn with sufficient force, to cut through the two inner tunics, secondary hemorrhage is almost certain to ensue. And why? Because the cellular coat has not been laid bare, from which alone it was possible for a fibrinous exudation to have taken place, by means of which, the coagulum could be fixed, and the aperture thus safely closed. The fact has been long known. Such I believe to be the true explanation of it.

Under these circumstances, we must conclude that the thickening, redness, and pulpy state, of the in-
Handbuch der Rationellen Pathologie
Band II p 302.
ternal tunic, which have been so frequently observed are always the result of mere mechanical causes, and that, if even a structure, like a false membrane, be found occupying the free surface of the inner coat, it is not the result of an "exudation" from the subjacent vessels, but of "deposition" of fibrin from the contained blood. In reference to this subject, Henle remarks, "There remain a few scatter cases, and these not enquired into with the necessary exactitude, in which after death the vessel membrane has been found vascular, and softened, and the inner surface covered with adhesive fibrinous flocculi. Future observers, who will wish to be believed, in their relations to the same effect, must show, that they are intimate with the difficulty of the diagnosis. It is necessary to possess the means of distinguishing the exuded layers, from those deposited either during life or after death. They must also not be ignorant of the possibility, which Virchow has first drawn attention to, that coagula of blood, or fibrin, which originate in very different parts of the blood-vessel-system, may be separated from the place of their origin, and be deposited in the Artery".
Atheromatous Degeneration

Upon Arterial degeneration much has been written, but to little purpose. The yellowish raised spots and the calcaneous plates, which so often occur in the arteries, and especially in the Aorta, have for ages attracted attention, but their nature, their exact position, and the manner in which they are formed, are questions in reference to which there is still much dispute. Pathologists are even at variance as to how many varieties of degeneration the arterial system may undergo, for while some affirm that it is subject to the Atheromatous, Semicartilaginous, Cartilaginous, Calcaneous and the Bony, others aver, that there are but two, the Atheromatous and the Calcaneous, to which, in its advanced stage, the term ossification has been erroneously applied. But, without investigating the cause of these discrepancies, we proceed to consider that variety of Arterial deposit to which the name Atheroma has been given. This, which is the most frequent disease of the Arterial system, consists in the presence of a yellowish matter of varying consistency, giving to the affected vessel very different appearances. In some cases, especially in the neighbourhood of the intercostal arteries, speckling the inner membrane with minute dots, while in others, or even in another portion of the same vessel, it involves great part of the inner membrane.
and presents a well marked prominence on its free surface. A small portion examined under the microscope, exhibits a number of oil globules of various sizes, often aggregated together, forming compound granular cells, along with numerous plates of Cholesterine and some granules. Hence this must be regarded as a fatty deposit, and thus the term 'Plasoma' is often substituted for that of Atheroma.

It is a favourite dogma with some, that this condition of the arteries occurs exclusively in those who have suffered from Rheumatism, or whose systems had been tainted by Mercury or Syphilis or both, without meaning to question the statement that it is often met with in individuals who had suffered in one or other of these ways. It seems most unphilosophical, to see in the comparatively rare affection the cause of a disease, which so generally affects mankind. However much they may increase the evil, the fact, that it is often met with independently of them, proves that they are not necessary to originate it.

It was at one time universally supposed, and the doctrine is still adhered to by many, that this deposit is the result of an inflammatory action of a low type, and hence it has been termed 'Chronic Arteritis.' It has further been generally described, as existing between the inner and middle coats, or as some have expressed it, in the subserous cellular tissue. The beat and source of
The atheroma, and its origin, whether it be inflammatory or not, are questions which are intimately linked together. If we believe that it is an exudation from the subendothelial vessels, its result of a Chronic Arteritis, but if it be proved to be derived from the blood circulating within the artery itself, then its production is altogether independent of inflammation. The facts regarding the distribution of the 'Vasa vasorum,' which have induced us to doubt the accuracy of those observations, in which inflammatory redness and softening of the inner vessel membrane have been described, lead us altogether to deny that these deposits can be the result of an inflammatory action at all. For, even admitting the views of the older Pathologists, that the atheromatous matter resides in the subserous cellular tissue, can we believe than an exudation, instead of appearing in the neighbourhood of the vessels from which it came, should penetrate great part of the thickness of the arterial coats, which is altogether non-vascular? And though Crisp and others have confidently asserted, that the atheroma does originate between the two inner tunicas, this observation has been distinctly negatived by the researches of others. As regards this point, much has of late been done by the German Pathologists, who have brought the microscope successfully to bear upon the elucidation of a subject, before raptur
Handbuch

p. 501
The greatest obscurity, "the seat of the atheroma," says Henle, is a membraniform substance on the free surface of the inner membrane, whose lamellae on the one hand resemble thin fibrous plates, and on the other the lamellae of the intima, and he believes, to be chemically a transition from between true fibrin and that modification of it which constitutes the intimated membrane. Whether it is to be regarded as an independent structure or as a mere hypertrophy of the internal membrane, it is difficult to determine, but the solution of the question is of no great importance in a pathological point of view. "The origin of this fibrinous layer," he proceeds, "is involved in the greatest darkness. There are two preliminary questions to be answered which it is not easy to separate from one another. 1. Whether the fibrin of the "tunica adventitia" is directly deposited from the blood, or by exudation from the vasa vasorum. 2. In what kind of causes does the deposit owe its origin? In replying to these questions, it is important for the proof of the proposition that the fibrinous layer is to be considered as an hypertrophy of the inner membrane, in the next place, to determine the origin of the material of the normal structure, and nutrition of the inner vessel membrane. I hold it as probable, that it originates from the blood, on this account,
that it is difficult to conceive why a structure, which is in constant contact with the circulating blood, should derive its plasma from the capillary vessels. I believe that the plasma of the blood contains, in the vessels, extends its nutritive influence as far as the middle coat, and hence seems to be explained the atrophy of the middle coat, which is the result of the thickening by Atheroma of the inner coat, were the nutrition of the inner coat dependent upon the deeper vascular layer, in the same manner as the dermis is dependent upon the cutis, then would the most recent deposits of Atheroma be found next to the vascular membrane, and the oldest at the free surface. The inner membrane is arranged directly the reverse in the normal condition, and in like manner the youngest lighter coloured layers of the atheromatous thickening are towards the surface, while the fatty degeneration and the ossification, which occur first probably in the oldest layers, take their commencement at the margin of the inner layer. The inner membrane remains unaltered in the beginning of the disease under the new layers, and it is only doubtful of the Epithelium, which is sometimes absent in healthy vessels, whether it is present or not.

Having adduced these arguments, derived from a consideration of the normal nutrition of the Arterial
Ob. Cit. A 70.
coats, and from a careful examination of Atheroma in all its stages, Henle goes on to strengthen his own opinion by the fact, that these deposits are met with exclusively in those parts of the system in which arterial blood circulates, the arterial fibrin apparently having an especial tendency to separate and become deposited on the vessel wall. Crisp advances the immunity of the Veins from Atheroma in support of his views, arguing that if the deposit has its source in the contained blood, it would occur most frequently and abundantly in those vessels, through which its passage is comparatively slow. This argument, while it does not in the least militate against the truth of the German doctrine, tells decidedly against his own: for, if the Atheroma be the result of exudation from the nutrient vessels, why does it never occur in the Veins, which possess them as well as the Arteries?

We believe then, that the Atheroma is a fatty degeneration of a layer of fibrin, deposited by the contained blood on the free surface of the vessel, which may be regarded either as a 'sirica adventitia' or as a mere hypertrophy of the internal coat, with which it soon becomes closely united. The older layers of the fibrinous membrane in fact die. The greater part of them is absorbed, and the fatty and mineral matter...
† See Appendix. A
are left behind. Or, adopting another theory of Patty regeneration, into which we cannot enter at large, the new structure improperly nourished dies, and the fibrin becomes converted into adipose matter. The deposit, at first very minute and superficial, gradually increases in quantity, and becomes covered by new laminae of fibrin, so that it is often found separated from the contained blood, by a membrane of considerable thickness. But, while this degeneration commences in the deposited fibrin, it is not confined to it. The inner membrane itself is soon similarly affected, and even part of the middle coat may become ultimately involved.

The Atheroma has been described as becoming in some instances soft and fluid, and making its way into the cavity of the vessel, by what process has not been explained.

Calcaneous Degeneration

That the calcanean degeneration, which, when advanced, has been termed ossification, is, in most most cases, but an advanced stage of the Atheroma, appears probable from the following considerations.

1. From the researches of Bichat, we learn, that Atheroma is most frequently met with in the middle aged. In them the calcanean degeneration is rare, while in the aged it is so common, that Bichat estimates that it occurs in
seven out of every ten individuals above the age of sixty.

2. Even in these old persons the Atheromatous is found associated with the Calcareous degeneration, and we can often trace the transition stages between the two.

3. On examining a Calcareous plate, of a very considerable degree of hardness, under the microscope, it presented, like the Atheroma, Cholesterine crystals and fat globules, the amount of granular matter being much increased. We find the very same conditions existing in other situations, and in none more frequently, than in the tumours of the uterus, which at one part are often soft and pulpy, while at another they present Calcareous plates. When they are so frequently associated with one another must there not be some connexion between them?

But, if the Calcareous be but an advanced stage of the Atheromatous degeneration, how is this change effected? Calcareous matter wherever it occurs, whether in the Lungs, in cases of cured Phthisis, or in the Bronchial Glands, or as in the present instance in the Arterial coats, must be derived from one of two sources. It is either the ultimate remnant of a once living tissue, that part namely which cannot be absorbed, or else it is deposited from the blood. The objection to the former view is, that the earthy salts bear to small a proportion to the whole tissue. We often find in those who have been long the subjects

2. *Comptes Rendus de l'Academie des Sciences*, Tome XX
of tubercular disease, that the Bronchial glands are completely converted into calcareous matter, and yet un-
diminished in size. We cannot believe that these at
one time were ten times as large, and yet they must
have been so, if the earthy matter be but the result
of the death of their tissue, unless indeed we sup-
pose that it is the product of the decay of numerous
successive crops of cells. We know that some bones are
developed in membrane, that in the formation of car-
tilage into bone, the earthy matter is first of all depo-
ited, not in the cells, but in the intercellular substance.
The absorption of the fatty matter of the atheroma is
doubt will leave some calcareous matter, may not
more be deposited from the blood? Or are the so-called
bony plates composed in great part of Cholesteroline,
which Becquerel and Rodier found to increase in
amount in the blood, as old age advanced? The cal-
careous plates, however formed, are found in different
situations in the arterial walls, sometimes covered by
a fibrinous layer, while at others they are completely
bare. They must frequently break loose from their
attachments, and be carried off by the circulation,
perhaps giving rise to obstruction in some of the
smaller vessels. The following case, which is exten-
sively interesting on other grounds, well illustrates...
From notes taken after the section.
Some of these points.


The Aorta when slit up presented the following appearances: "Numerous atheromatous streaks are scattered over its surface, especially near the origin of the intercostal arteries. There are several protuberant patches of atheroma, about the size of split peas; they are less prominent, but more diffuse. The small points of deposit are near the surface, but the larger collections are covered by a membranous layer, in some cases as thick as the 1/6 of an inch. The larger patches are of varying consistence. In the lower part of the Aorta are numerous calcareous plates, in some cases covered by a thin fibrous layer, in others quite naked. Many present ulcerations around their edges, and about half an inch above the bifurcation of the Aorta is an ulcer of irregular shape and ragged margins which has evidently been but recently occupied by a ligneous lamina."

These are facts, but how to explain them is a matter of some difficulty. Unless it be, that the whole tunica adventitia and inner membrane have been involved in the degeneration, and no new fibrous layers are deposited, and that the hard plate, by its sharp edges acting on the neighbouring parts, gradually cut..."
On the Diseases of the Organs of Circulation and Respiration
its way out mechanically, I cannot account for them.

This calcareous degeneration, which most frequently occurs only in small irregular plates, often involves the whole circumference of an artery. The Coronary and Cerebral are the most frequent subjects of this so-called ossification, and the aorta, especially at its orifice, has been converted into a rigid and unyielding tube.

But while the Calcaneous is generally the result of the atheromatous degeneration, it is by no means invariably so. In such cases it must generally be regarded as a part of the general tendency of old age. It is only after many years that the skeleton may be said to be completed and new in advanced life those parts begin to be ossified, which had previously been composed of a different tissue. So it is that Calcaneous matter is deposited in the cartilages of the larynx, and frequently also in the inner vascular membrane. The Calcaneous degeneration is however not confined to old age. Calcaneous plates have been often met with in adults, and a few cases are on record, in which they were found in the aorta of infants.

Semi-Cartilaginous Patches have been described as occurring on the free surface of the inner arterial membrane, but according to Haeckel they never ossify. Other arterial degenerations have been spoken of by authors, but they do
not require notice.

Aneurism

But we will not dwell longer on the consideration of a subject, which, however interesting in itself and important in its results, is attended with great difficulty, is involved still in considerable obscurity, and is one upon which it is to be hoped much light will soon be thrown. It is an evil dangerous only in its consequences, and of these the most frequent and formidable is the production of aneurism. Introduced into medical nomenclature at a time, when very erroneous notions were entertained regarding the disease, which it was meant to designate, this term has ever since been employed, but in very different senses, by various authors, while the names, "true," "false," "mixed," and a host of others, which have been given to the several varieties which it presents, not only convey to the minds no idea whatever, but have been applied to such dissimilar conditions that the greatest confusion has been occasioned. It is unnecessary to cite illustrative instances of the truth of a statement, which the works of all who have treated of the subject amply prove. So much is it the fact, that before we can understand any thing that has been written upon the subject, we must first make ourselves acquainted with the sense in which the author employs the common terms. The general
Name itself is spoken of very differently by various authors, and from the very dissimilar conditions, which it has been by all considered to include, it sets a logical definition at defiance. Without new making the attempt to define an "Aneurism," we will rather endeavour to describe it, by considering the principal forms which it presents, and resume our notice of the other and rarer varieties, as we happen to meet them afterwards.

I By Dilatation is understood that variety of Aneurism, in which there is enlargement of the whole circumference of the Artery. This may include but a small portion of a vessel, or it may involve great part of it. In some instances it is abrupt, the limits between the normal and the expanded portions being well defined, while in others it gradually enlarges, and again gradually regains the healthy calibre. In the former the dilatation is Cylindrical: in the latter fusiform. Again the pre-natal enlargement may be limited, in greater part to one aspect of the vessel, and then it is Sac.-fusiform, a term which must not be confounded with Sacculated.

II When one or more of the Arterial Tunics is expanded to form a pouch or cyst, whose cavity communicates with the vascular channel, a True Aneurism is formed.

III. When the Aneurism is constructed, not of the vascular wall, but of the surrounding tissues, whatever they be. The Aneurism is termed False.

IV. Frequently the Aneurismal Sac is formed partly of the arterial tunic and partly of the contiguous tissues, and then it is said to be Mixed.

Men are much more subject to the invasion of this most formidable affection than women, and while the comparative immunity of the latter is exhibited more strikingly in external than in internal aneurisms, there is yet so great a contrast between the sexes in regard to their general liability even to static aneurisms, that according to Dr. Greene, of every 10 cases of this grave disorder, eight are met with in men and only two in women. It has generally been believed that this great difference was due, not to any predisposition which the one possessed to much more strongly than the other, but to the fact, that men are much more exposed to the exciting causes of Aneurism from the laborious nature of their occupations. But Mr. Porter has satisfactorily proved that this theory is altogether unfounded, because: 1. Women among the lower orders frequently go through as hard work as the men, and are in fact often engaged with them in the same occupation. 2. Because the most laborious men in society, such as Blacksmiths, Sailors &c., are not a whit more
liable to the disease than any other class of men in the community. And 3. Because Aneurisms is met by any means more frequently met with among the poor than among the rich. We must therefore look for the explanation of the fact— that men are much more frequent subjects of Aneurisms than women— not in the nature of their occupations, but in some cause of more general application; and this has not yet been pointed out.

We have already stated that arterial degeneration and Aneurism have ever been regarded as intimately related to one another; so much so, that the former has by not a few been regarded as a condition, the preexistence of which is indispensable for the production of the latter. For, though Aneurisms are frequently to all appearance the result of blows and other external agencies, they believe that a healthy vessel in similar circumstances would either not suffer at all, or if it did, that it would speedily arrest the mischief by the exudation of Plastic lymph, by which the breach of continuity would be soon repaired. But without subscribing to these views in all their extent, no one can for a moment doubt that a diseased condition of the arterial coats and particularly the atheromatous, is the great agent in the production of Aneurisms. It is easy to understand, how this cause
is quite adequate to account for the effect. The inner mem-
brane, thickened by the deposition of successive layers of
fibres and, by the formation of fatty masses in its sub-
stance, consequent upon their decay and death, much
impedes the proper nutrition of the middle coat and
to causes its atrophy. With its slow but sure wasting
the artery loses its vital contractibility. It yields before
the wave of blood as it used, but is unable in its en-
feebled state to recover itself by contraction, and thus
it becomes permanently enlarged. According to the
extent and stage of the degeneration is the result. If
the whole circumference of an artery be pretty equally
involved, the whole circumference yields, and a dilata-
tion is the result. If one side of the artery be more
affected with the mortisid deposit than the other, the
dilatation is eccentric, and, according as the coats are
gradually or suddenly involved in the degeneration,
the splindroid and fusiform varicities are produced.

It was a point, long and keenly contested,
how a true aneurismal sac was formed. Scarpa, on
the one hand, held that it was always produced by
a rupture of the inner membrane, while others as clart-
ly maintained that all the arterial tunics were in
every instance dilated. Here, as in many other med-
ical controversies, both parties were too exclusive, and
virtually believed the views of their opponents impossible, because they themselves had never seen them illustrated in any instance which fell under their own observation. And yet it cannot be denied, that the question is frequently one by no means easy to determine, especially in those aneurisms which are of old standing. In them altered to a great extent by pressure on surrounding parts, and by the presence of coagula in their interior, it is often impossible to separate the arterial tunics from one another and from the contained fibrous deposit. As the result of many careful dissections however, and of the examination of numerous commencing aneurisms, we know that true aneurisms probably are more frequently formed as Scarpa describes, but that they often originate in an expansion of all the arterial tunics, and in not a few cases preserve them all entire, even after they have attained a very large size. In other cases an aneurism commenced by dilatation proceeds to rupture of the inner membranes. There are in fact three ways in which a true aneurismal sac may be formed. 1. By a gradual expansion of a limited portion of the arterial walls, owing to advanced degeneration of that particular part. 2. An aneurismal sac true commenced, owing to some muscular evertion, or to some external injury may have its
inner membranes torn across, and the sac always rapidly increases in bulk immediately after. 3. The inner membrane may be absent from the detachment of a calcaneous plate, or it may have been divided by ulceration, or as more frequently happens the inner coats are suddenly ruptured by some violence. Generally the rupture, whether primary or following dilatation, is of very limited extent, and the blood, insinuating itself into the narrow aperture, acts on the cellular coat, and distends it into the sac. Thus, while the aneurismatic cyst may be very large, the communication with the artery is often very narrow.

The aneurismatic condition of a vessel, having been once established, becomes the subject of many and important changes. In it indeed two agencies are at work, diametrically opposed to each other. One, the force of the circulation, causing enlargement of the cyst thinning of its walls, and in most cases ultimately ulceration or rupture; the other, the coagulation of blood within the sac, by which its capacity is diminished, its pannicles thinned, and strengthened, and by means of which in some favourable circumstances a spontaneous cure has been effected. In mere dilatation, coagulation rarely takes place at all, and it is comparatively seldom met with in those cases where all the arterial coats enter
Hope, op. cit., p. 396.

Referring to, by Henle in his Handbuch, Band II, p. 733.
into the formation of the sac, partly because in these circum-
stances the communication with the vessel is generally
free, and partly owing to the looseness of the inner mem-
brane. But in that most frequent variety of aneurysms,
where the inner coats are ruptured, the circumstances
are favorable for coagulation, the surface being compara-
tively rough, and the aperture leading into the sac
small. Successive layers of fibrin are found deposited,
the inner or more recent having all the character of
the clot, while the outer or older laminae are decolori-
zed and membranous. The process may steadily ad-
vance until the whole sac is converted into a solid
mass, and then all further mischief be prevented.

But the termination of aneurysm in spontaneous
cure is unfortunately extremely rare. In general the
tumor slowly but steadily enlarges before the force
of the circulation, the size to which it attains, and its
rapidity with which it advances, being determined by the
condition of the arterial tunics, the strength of the circu-
lation, but mainly by the nature of the surrounding parts.

The changes which occur in the coagulum
within an aneurysmal sac may be regarded as identical
with those which have been observed in the Thrombus of
a ligatured artery, and which have been minutely de-
dcribed by Zweicky. According to this observer, the clot,
which during the first eight or ten days presents little or no change, about the second week begins to diminish in bulk, and becomes also gradually decolorized, passing from scarlet to rose-red and from that to yellowish white. These alterations are dependent upon changes in the contained blood globules, which ultimately disappear, and that in two ways. The greater part of them very soon cannot be detected at all, having left no trace behind them, but "whether the membrane bursts, allowing the escape and subsequent dissolution of the contents, or whether the corpuscles have become clear and so are invisible", has not yet been determined. The other and smaller number of the blood globules undergo a chemical alteration in their membranes and contents. They gradually change from a thinning yellow to a blackish brown, while they at the same time lose their disk form and smooth margins. They soon become wrinkled and smaller and smaller till they are not larger than minute points and finally disappear. During the first two weeks the fibrin, the portion of the coagulum softens, and in this process various cell formations are being produced. At the close of the second week, small round nuclei are developed, which soon arrange themselves in rows, and lengthen in the direction of the future fibres. As this process advances, individual broad fibres can be
Band II p. 722.
isolated, and then also are to be seen numerous nuclear cells in various stages of the process of elongation, so that, towards the end of the fourth week, the whole consists of broad and flat fibres provided here and there with nuclei, which present the general appearance of the unstriated muscular fibre. Towards the eighth week these fibres are observed to have split into fibrillae, and to have assumed the characteristic appearance of the white fibrous tissue, the nuclei having become developed into nuclear fibres.

Nor are important changes to be seen in the sac alone. The contiguous tissues in process of time become materially altered, and the functions of neighbouring organs are often dangerously interfered with. Bone becomes rapidly absorbed. Cartilage resists longer, while ligament and tendon yield comparatively little. A nerve may be implicated; pain is occasioned in the region of the tumor, and loss of function in the part which the nerve supplies. As the sac advances by continued pressure its walls may be absorbed to a considerable extent, and then the surrounding parts, as bone or fibrous tissue, which have become adherent to it, may form part of the panniculus of the cyst. The aeurism becomes mixed. Ultimately by ulceration and sloughing or by rupture, the cellular tunic being incapable
[Text not legible]
of further distention, some important canal or cavity is opened into, and death is either instantaneous, or the result of oft repeated haemorrhage. According to Hodgson, when the sac presses externally, or into a cavity lined by a mucous membrane, it proves fatal by the separation of a slough, but when it projects into a serous membrane, the parieties of the tumour gradually thinned at length give way by a crack or fissure, through which the blood is discharged.

A false aneurism is generally the result of a wound or of laceration. In some rare instances it is formed by the ulceration of the arterial coats, from the presence of an abscess in the immediate vicinity.

But, passing from these considerations which refer to aneurism in general, we come now to speak of Aortic aneurism in particular. And of all aneurisms this is the most frequent, and the most formidable.

The ascending and transverse portions of the arch are the most subject to dilatation, and when the latter part is enlarged, the vessels which spring from it are in general more or less involved. The dilatation may be but slight, and may occupy but a limited portion of the vessel, or it may extend for many inches, and may steadily enlarge till it has attained twice, or some rare cases, even four times the natural calibre. When
Guy's Hospital Reports. Vol. III. p. 393.
the orifice is involved, the valves are generally rendered incompetent, just as if they themselves had been the subjects of disease, but not unfrequently regurgitation is altogether prevented by an enlargement of the valves correspondent to the increased aperture. In speaking of the aortic orifice, the same point has not been referred to by different authors, for while some apply the term to that portion which is on a level with the free borders of the valves, others signify by it that part which corresponds to the line of their insertion. As the result of numerous measurements, Sir Cheever believes that the normal circumference of the canal in the former situation is 34 lines, while its calibre at the latter point, which he regards as the true orifice, equals 36½. The one however he finds to be much more dilatable than the other, for while the upper can be distended to 43 lines the lower cannot be made to measure more than 39½. He believes that it is only when the real orifice is dilated that the healthy valves become incompetent, and that the upper portion may be enormously enlarged and yet no regurgitation take place. Dilatation of the real orifice he conceives to be generally the result of hypertrophy of the ventricle. And here we may for the sake of convenience refer to that claim.
† See Appendix B

Fistula of the ascending aorta rupturing into pericardium.

Dr. Stokes. Dublin Journal - vol 5 p. 119.
unfrequently met with. Stricture. This may be congenital, or it may be the result of thickening of the walls dependent upon disease. It also presents a barrier to the circulation, and will in time cause hypertrophy of the left ventricle.

Dilatation rarely causes any serious changes in the surrounding parts, but as it affects an impediment to the circulation, it cannot exist long without inducing hypertrophy of the left ventricle, even though uncomplicated with vascular disease. It seldom terminates in ulceration or rupture, though a few instances of this occurrence are on record. In some cases the dilatation consists of a series of pouches, separated from one another by more contracted portions, which give to the Aorta an appearance very similar to that presented by the transverse Colon. When the Thoracic Aorta is enlarged, the expansion is generally saccular or fusiform, and in this situation rupture is not uncommon. The following case of fusiform dilatation of the Thoracic Aorta, proving fatal by rupture into the left pleura, fell under my own observation.

Mr. Taylor, 53 years of age, had complained for several months of occasional pain in the left side of his chest, and had during that time been subject to cold clammy sweats, and fainting fits, from which she always recovered by keeping the recumbent posture.
for a little. Went to bed in her usual health on the evening of
Tuesday 5th October 1850. At 3 a.m. on the following morning she got
out of bed, complaining much of a feeling of cold in her back,
and expressed a desire to have it rubbed. She then lay down, and
after a few groans immediately expired.

Autopsy at her own house, 36 hours after death.

On removing the sternum, the left lung was found much col-
lected. A solid clot of blood was observed to protrude between the left
lung and the Pericardium. On more particular examination, it
was seen that the left lung was of very large size, for while a considerable portion lay in front of
the root of the lung, by far the greater part was concealed be-
hind. There were no means of weighing it, but it measured
2/2 pints. Surrounding it in the left pleura was from 8 to
10 pints of bloody serum. The heart was considerably enlarged,
and flabby. It appeared to be fatty, but it was not examin-
ed under the microscope. Valves quite healthy. The ascending
Aorta was slightly enlarged, and presented numerous patches
of Atheromatous deposit. About 2 inches below the origin of the
left subclavian artery, the Aorta began gradually to dilate, and
soon became twice its natural dimensions. It then again
gradually resumed its normal calibre. The dilatation was
5 inches in length, its inner surface was studded with large
patches of Atheroma. The aortic walls were throughout this por-
tion very thin, and became more and more so till on the anter
Statement made by Guthrie, op. cit., p. 70.
An aspect of the vessel, at its widest part, was a tear about an
inch and a half in length. Brain healthy. Abdominal cavity
not examined.

It was stated by Scarpa and his followers, in sup-
port of their view, that an aneurism could never form
in any part of the Ascending Aorta, because it wants the
Cellular coat, which according to them is the sole con-
stituent of the sac. If any additional argument were
wanting to combat the exclusive view of this great-
anatomist upon this point, it is the fact that Aneu-
riesms do often form in this part of the aorta.

On slititg up the aorta, it is found to present on
its inner surface three depressions, corresponding to the
Semituunar valves, and immediately behind them. These,
which have been termed the "Sinuses of Valsalva," may be
distinguished as the "Right" and "Left," from each of which
the Coronary artery of that name springs, and the "Post-
terior" or "Intercoronary." Of these the "Right" is the most
common site of Aneurism, but not unfrequently two of
them have been found converted into aneurismal sacs,
and in some rare instances the whole three have been so
involved. More frequently the aneurism is higher up
in the aorta, and from in general attains a larger
dimension. When that portion of the ascending aorta imme-
diately above the sinuses of Valsalva becomes the seat of
Aneurism, the sac generally commences opposite to the attachment of the semilunar valves, and thus in the space alternating with that above the free border of the valves. The accompanying drawing represents an incipient aneurism, situate partly above the intercoronary valve, and in part above the septum between it and the right semilunar valve. It also affords a good illustration of vegetations on the valves.

Robert Mason, a farm servant, was admitted into the Clinical Ward October 5, 1853, suffering from dyspnoea, palpitation, and all the symptoms of Cardiac disease. On auscultation a loud bellows murmur was found to take the place of the second sound. He died on Oct. 20th.

Autopsy 24 hours after death—Aortic valves were fringed with excrescences along their free margins. The valves themselves were not much shortened, but were somewhat thickened. The vegetations were soft, whitish, and irregular in form, firm at their attachments, but soft and easily torn at their free extremities. A few vegetations of smaller size existed below the aortic valves on the Endocardium, and numerous small granulations occupied the surface of the Mitral valves. There was a small commencing aneurism above the right coronary artery, and above the left vein connecting the posterior with the right semilunar valve. This admitted the point of a finger. In the neighbourhood of it were warty vegetations. The inner coat of the vessel was
Copied from the Pathological Record. Vol. XIII.
very thin, or absent over it, and the transition between the aneurysm and the healthy structure was marked and abrupt.

It is evident how an aneurysm, formed on the great arterial trunk, more especially when as yet it has given off no branches of any size, should materially interfere with the heart's action, and, when we call to mind the many important vessels and organs by which it is almost literally surrounded, we are prepared to expect very serious results from a consequent interference with their function. As the tumor enlarges, it may press upon the thoracic walls. It causes absorption of part of the sternum, and of one or more of the ribs generally of the right side, and then pulsates externally covered only by the integuments. Soon they become thinned and discoloured, and one or more sloughs separate. A fatal haemorrhage may carry off the patient at once, but more generally the fibrin in the sac plugs the aperture, and deceives life for a time. More frequently the wedge becomes loosened from time to time, and the unhappy victim bleeds at last worn out by the oft repeated haemorrhages. But, instead of pressing forward on the ribs, the sac may bulge to the right, and then often the Vena Cava is compressed. The head and upper extremities have thus their venous return impeded, and the superficial veins on the thoracic walls become immensely enlarged. In these circumstances the patient presents
1. Practice of Physic - Vol. II p. 306

   Pathological Society of London Reports - p. 232. Dr. Lillie's case of aneurism of ascending aorta causing obliteration of supra cava and rupturing into pericardium.

a most singular aspect. The lower half of the body is of its natural dimensions, not unlike very much emaciated, while the head and upper extremities are prodigiously swollen and oedematous. Such cases are narrated at length by Dr. Watson and Mr. Law. If the patient survive, the Vena Cava superior becomes permanently narrowed. In some instances its cavity has been completely obliterated. When the sac projects to the left, the Pulmonary Artery may become similarly involved.

In general the fatal termination of the aneurism of the ascending Aorta occurs by rupture into either Pleura, or into the substance of the lung, or externally. It was generally believed that rupture into the Pericardium was a very uncommon occurrence. Laennec saw but one case of it, and Hope pronounced it to be "extremely rare." Crisp on the other hand maintains that, "so far from being "extremely rare," it is the mode in which aneurism of this portion of the Aorta most frequently terminates, and his statistics fully bear out this statement, as of 78 cases of aneurism in this situation, 30 burst into the Pericardium, while rupture externally, which is the next most frequent result, occurred only 6 times.

We have already seen that an aneurism of the ascending Aorta may be pressed upon one or other of the important vessels which lie on either side of it, a

greatly to impede their function. In some rare instances the sac has been found to open into one of these large trunks, while in other cases a direct communication has been established without the intervention of an aneurismatic cyst. The first condition has been known by the name of "Varicose Aneurism," while the second has been called in contradistinction "Aneurismatic varix," but we will speak of both under the former as a generic term. Such a lesion had long been known at the bend of the arm, as being formed occasionally by the rash or unskillful use of the lancet, but that it ever occurred spontaneously was entirely overlooked.

Mr. Syme published a case of spontaneous varicose aneurism of the Abdominal Aorta and Vena Cava. In an interesting paper in the Medico-Chirurgical Society's Transactions, Mr. Humphry has collected a number of cases illustrative of this curious condition. He adds, in all 8 cases of its occurrence in the ascending Aorta, and refers to a few preparations in the museum of Guy's, St. Bartholomew's, and other hospitals, in which this condition is either fully established, or in process of formation. Of the 8 instances detailed at length, one communicated with the Vena Cava Superior, another with the appendix to the right Auricle, a third with the right Ventricle, while in four the sac opened into the Pulmonary Artery.

In one unique example the Right Auricle, Superior
1. Archives Générales - Sept 1846 - Case by J. Gouye
4. London Medical-Chirurgical Society's Transactions - Vol. XXX - p. 18
Cava and Aorta all directly communicated with each other by means of an aneurismal sac. In addition to the cases recorded by Mr. Prinsep, I have met with four other examples of Varicose Aneurisms of the Ascending Aorta. In one, originally published in the Archives Generales and copied into the Monthly Journal, the sac communicated with the Vena Cava Superior. In two others, related by Mr. Smith, the opening was into the Pulmonary Artery. Mr. Beck has recorded an instance of an aneurism of the ascending Aorta communicating with the right Ventricle, being, so far as I know, the only other example of this condition besides that of Mitchell referred to by Hope, and detailed at greater length in Mr. Prinsep's paper. In Mr. Beck's case there was also a communication between the two Ventricles. In most instances, while the Aneurism was formed gradually and its walls thinned by degrees, the Varicose condition was established suddenly as the result of some unusual exertion. The Patient feels then as if something had given way in his chest, and immediately after experiences great aggravation of the dyspnoea, palpitation, and all the other symptoms which the simple Aneurism had produced to a much more limited extent. In other cases however the process has been gradual, and throughout one of ulceration and softening. As might be supposed, from so serious an obstacle to the circulation, and from such a direct commingling
Of the arterial and venous blood, the anasarca was in every case great, and the dyspnoea very urgent; while in addition the temperature of the body has been observed to be considerably lowered, and the face and neck especially livid and bloated. Death soon ensues generally preceded by delirium and convulsions.

If aneurisms of the ascending Aorta produce serious consequences by pressing upon and opening into important parts, a similar condition of the remaining portion of the Arch is no less formidable in itself, and its results. The structures in its neighbourhood are different, but their relations are as intimate and their functions no less important. In this position the sac is at first generally formed by an expansion of all the arterial coats. The patient may labour under dyspnoea, palpitation, and anasarca, for many weeks or months without any notable change, when suddenly in the act of coughing or vomiting, or during some other violent exertion, or under the influence of some very strong mental emotion, he hears a distinct crack, and feels as if he had received a severe blow. The symptoms become speedily aggravated, and the tumour in a very short period attains several times its former dimensions. The inner coats have given way, and the cellular tunic has been distended to form the enlarged sac. As it increases in size, it may rise to the root of the neck and pulsate above the tip of the sternum.
As happened in a case given by Dr. O'Brien.

More generally it advances in other directions. Sometimes it compresses the origin of the Arteria inominate, and then the pulse at the right wrist becomes much weaker than that at the left, and may at last be altogether imperceptible. In other instances it obstructs the Vena inominata, or the Superior Carotid, or the left division of the pulmonary artery. Important consequences further result from interference with the respiratory and digestive organs, or from involvement of the important nerves which pass in its immediate vicinity or cross over it. The trachea may be compressed just where the Aorta rests upon it, or one of its divisions may be obstructed, and then the corresponding lung cannot carry on its important function, and remains almost motionless, even on a full inspiration. It has been observed that the left bronchus is affected in this way more frequently than the right.

The Aneurism again may press on the aecophagus, and more or less dysphagia is occasioned, according to the amount of pressure exerted. At first the patient in swallowing may complain of some slight uneasiness at one particular point. As the tumour enlarges, the difficulty increases. Soon he cannot swallow solids, and ultimately even fluids may refuse to pass. Such symptoms have not unfrequently been referred to structure of the aecophagus from disease resident in
itself. Under this erroneous impression, tongues have been assiduously employed, and these of course only increase the mischief and hurry on the fatal terminations. And yet we may know that the diagnosis is not always very easy, when we remember that such an error was committed by the late Sir Charles Bell! The pulmonary Pleura may be stretched and irritated before the advancing aneurysm, and thus the dyspnoea is increased. More frequently the left recurrent laryngeal is implicated, and this in a great measure explains the Aphonia, which has been often met as a concomitant of aneurysm of this portion of the Aorta. In such instances the nerve, after death, has been found flattened and compressed, and the muscles of the larynx which it supplied atrophied. While complete aphonia is but rarely met with in connection with Aortic aneurysm, the voice is in most cases more or less affected; being in some feeble, and whispering, in others husky or even rough and hoarse. But while the pressure on the superior laryngeal is in some instances so great as to induce paralysis, in others it is sufficient only to irritate, and then we have the cough singularly modified, acquiring a loud and singing character, and often followed by crowing or stridulous inspiration. Not infrequent by the inflammation caused by the pressure of
an aneurism on the trachea spreads upwards to the larynx. More frequently there is oedema of the glottic dependent upon the impediment to the venous return, and this serves, along with the involvement of the nerve fibres, greatly to alter the voice. The symptoms of laryngitis may be very closely simulated by the effects of Aortic Aneurism. In one case related to this "Lancer", the man had been for some time blistered and otherwise treated for supposed inflammation of the larynx. The dyspnoea however gradually increased, until when "in articulo mortis" tracheotomy was performed to save him from suffocation, but without relief. After death the larynx and trachea being examined did not indicate the slightest lesion. There were two aneurisms of the aorta at its arch.

Aneurism of this portion of the aorta, if the patient survive the harassing symptoms which it occasions, generally proves fatal by opening into one or other of the various cavities against the parietes of which it presses. It may burst externally, or into the substance of the lung, while in other instances it ruptures into one or other of the Pleurae, or into the posterior mediastinum. More frequently it ulcerates into the trachea, or into the oesophagus. In the former instance two or three apertures of communication generally form, and become closed for a time by portions of the clot. The patient may live for many months.

Suffering only from occasional attacks of haemoptysis. Even this may be entirely absent, when suddenly, after some unusual exertion, or even without any apparent excitement, the fibrinous wedges become completely displaced, and a fatal haemorrhage ensues. The left Bronchus is the seat of these changes, almost as frequently as the Trachea itself. When the Aesophagus is opened into, it also may be similarly closed for a time. The individual, after a fit of coughing or vomiting, brings up a stringy-looking substance, which looks very like, and has been mistaken for, a piece of meat, but almost immediately a gush of fluid blood follows, and discloses the true nature of the case. In some rare examples the Aneurism has been found to have perforated both Aesophagus and Trachea.

When an Aneurism is seated in the upper part of the Thoracic Aorta, it may extend upwards, press upon, and ulcerate into the very same parts as a similar condition of the descending portion of the Arch. Thus it has been found to open into the left Bronchus, and into the Aesophagus. In one instance it formed a varicose aneurism by communi
dating with the left Pulmonary Artery, but in many it had more or less obstructed that vessel or it may compress the substance of the lung itself, and when
1st Momson's Case. Pathological Society of London. Reports
Third Session. p. 15.

2nd. cit. p. 12.
This occurs in the lower part of the chest, the dulness on percussion with increased vocal resonance, and not unfrequently crepitant râle, conjoined with febrile symptoms, have led the Practitioner to imagine that the patient laboured under Pneumonia. Again the veins at the root of the left lung may be pressed upon, and by impeding the return of blood from that organ, its function is materially impaired, and Pulmonary Apoplexy has been occasioned. More frequently the aneurism advances against the vertebrae. These soon become greatly diminished by absorption, and as the walls of the sac disappear, the osseous structure itself may come to be washed by the wave of blood. In such a case the resistance which fibrous texture presents to pressure is well illustrated, for while the bodies of several vertebrae are lessened by one half or more, the interosseous substances protrude between, little or in no way altered. In some instances the bones become carious. In other cases the thoracic extremities of the ribs disappear, and the aneurism forms a considerable tumour on the back. Dr. Hope relates such a case which presented the additional peculiarity of having the sac adherent to the pericardium. In general the aneurism ruptures into one or other Pleura, generally into the left. In these solitary instances it was known to burst into the spinal.


Aneurism of the abdominal aorta differs in some particulars from a similar condition of that vessel within the thorax. The walls of the cavity being much more yielding, the sac usually attains a far greater size, but for the same reason it comparatively rarely produces marked changes in surrounding parts. From its much more intimate connection with important nervous centres, it causes much more pain, though at the same time the patient is free from many of those harassing symptoms which generally attend an aneurism within the thorax. But while these statements are true to a considerable extent, they are by no means universally so. In some instances, for example, the tumour may be bound down by old adhesions of the viscera, or, when situated in the highest portion, it may be traced down by the crura of the diaphragm, and then the vertebrae may become absorbed, and sometimes even carious. When leasat behind the stomach, even when yet small, it may interfere with the function of that organ, inducing anorexia, nausea, flatulence, and all the other symptoms of dyspepsia. When seated lower down, it may affect the intestines causing alternation of constipation and diarrhoea. It has been known to produce an attack of severe colic. In other cases it has given rise to involuntary evacuations. One curious example
is on record, in which an aneurism of the abdominal aorta produced all the phenomena which usually attend on, and are regarded as characteristic of, urinary calculi. These various symptoms are occasioned, in part, by mere mechanical irritation, and partly, we doubt not, by the influence exerted by the tumour on the various nervous plexuses, which are so large and so numerous in this cavity, and upon the integrity of which the several abdominal viscera seem chiefly to depend, for the proper discharge of their important functions. This irritation and tension of the nervous fibres further explain the excruciating pain, which so generally accompanies abdominal aneurism, and which is generally described by the patient as of a lancinating character. When the aneurism is seated near the insertion of the diaphragm, it may prevent the proper descent of that muscle and to impede the inspiration. Not unfrequently aneurism of the abdominal aorta causes little or no inconvenience during life. In other cases the symptoms may have been very urgent, without the real cause having ever been suspected. And this has occurred to the most experienced practitioners.

Aneurism of this portion of the aorta generally terminates by rupturing beneath, or into, the peritoneal sac. In other cases it has ulcerated into the intest

2. *Dublin Hospital Reports* Vol. V. p. 166


5. *Dublin Hospital Reports* Vol. V. p. 188


times, and deluged them with blood. More rarely it has
burst into the thoracic cavity, either into the posterior and
diastemum or more generally into the left pleura. Cases
illustrative of this latter mode of termination have been
recorded by Dr Stokes, Dr Beatty and Dr Law. In one example,
which appears to be quite unique, the aneurism burst on
to the substance of the lung itself. In another, which seems
to be the only one of the kind on record, it opened into
the spinal canal. The tumour sprang from the abdomi-
nal aorta above the origin of the coeliac axis. "At the left
side of the eleventh dorsal vertebra an opening, large
enough to admit the finger, was found leading into the
spinal canal." The condition of varicose aneurism is
sometimes established between this portion of the aorta
and the ascending vena cava. Several such cases are
alluded to by Dr Humm, and another curious in-
stance has been detailed by Dr Brampton, in which
there were two apertures of communication. As the
aneurism advances, the peritoneum in general forms
a great part of the sac, and then the tumour may at
tain a size, which appears almost incredible. In one
case the contained clagulum was found to weigh
10 lbs, while in another the cavity of the sac was cap-
able of containing a pailful of water.

But it must not be imagined, that in
Lancer. 1835-36 p. 264.
This or in any other part of the aorta, an aneurysm goes on in every case advancing, until it either bleeds externally, or opens into some internal cavity or organ. Much more frequently the patient, worn out by dyspnoea, sleepless nights, horrid dreams, and the many other and painful concomitants of this dreadful disease, succumbs long before the aneurysm has seriously involved the surrounding parts, and not unfrequently while as yet it is but of small size. In other cases, and these very difficult of explanation, an aneurysmal sac causes little uneasiness. The patient is able to follow his usual avocation as before, and in some instances has almost never complained of illness, when suddenly he falls down and almost immediately expires. A post-mortem examination discloses the existence of an aneurysm, it may be of no considerable dimensions. This was well illustrated in the death of Sir David Barry.

The sac of an aneurysm, while generally composed either of all or only the outer coat of the vessel, sometimes presents other and curious structures. It has been formed of the inner coat alone, the other two having disappeared; or the reverse more frequently happens, the two outer remaining while the inner is gone.

Cases are mentioned by Tubois, Suppleton, and Lister, in which the inner tunic was protruded through


the middle coat, and reaching the external one, has formed the sac along with it. Specimens, illustrative of a similar mode of formation, were exhibited to the Pathological Society of London by Dr. Macock.

Spontaneous Cure is unfortunately an extremely rare termination of Aortic Aneurism. In many cases the sac has been found to contain a large amount of coagulum, and in a few to be in great part filled with it, but complete obliteration of the cavity is almost never met with. Corvidart described small hard lumps which he found on the walls of the Aorta, under the name of "extraneous tumours," but Hodgson was of opinion that these were in reality examples of Aneurisms which had undergone a spontaneous cure. And here we may advert to those few cases, as they have occurred generally in connection with Aneurism in which the cavity of the Aorta has been found completely blocked up. One such instance has been recorded by Dr. Good, and another by Dr. Alexander Monro. In the former the Aorta was "obliterated from the origin of the inferior mesenteric artery downwards for the remainder of its length," and the common iliacs were similarly blocked up for several inches. In Monro's case the obliteration was situated immediately above an aneurysmal sac, which had itself become completely filled.
up. The plug was wedge shaped, and firmly adherent to
the inner aspect of the vessel. It seemed to be composed
of a solid mass of coagulable lymph. In both cases the
arteries arising from the Aorta above the obstruction were
very much enlarged. The examples of this very singular
case of the great arterial trunk are so very few, and our knowledge in regard to them so vague, that
it is impossible to arrive at any very satisfactory con-
clusion. If what we have already stated be the fact,
then it is evident the obstruction could not have con-
sisted of coagulable lymph, provided the inner mem-
brane remained intact. It was no doubt merely a
coagulum but why the blood should be stagnate, it
is difficult to explain.

False Aneurism is rarely met with in the
Aorta, the several causes, which produce this condition
in the other arteries, proving in general almost instantly fatal when they affect the great trunk. The
immediate vicinity of an abscess, ulcerating through the
vascular walls, and so filling with blood the cavity
which had previously contained pus, has been known
in some few cases to operate on the arteries of the ex-
tremities, and there are not wanting cases, though
extremely rare, in which the Aorta has been similarly
affected. Mr. Buxton surgeon to Dreadnought has re
corded an example, in which this condition was undoubt-
edly established. The patient, a woman of advanced
life, had suffered for 14 years from an abcess in
the lower part of the neck. This ultimately ulcerat-
ed into the Aorta, but, as the abcess had already
opened externally, much haemorrhage resulted, and
the patient survived only 48 hours.

There is yet another mortis condition of the
Aorta, which though it differs very materially from the sever-
al varieties which we have already described, has been in-
cluded with them under the general and comprehensive
term—Aneurism. This peculiar form which has been
designated "Dissecting Aneurism", and which is met
with almost exclusively in the Aorta, is produced when
the vascular tunicies are more or less separated from
one another, by the infiltration of blood between them.
In most examples the inner membranes having given
way, either from some external injury, or as the result
of disease, the blood insinuates itself into the fissure,
but instead of distending the cellular coat into a
sac, it burrows between the arterial tunicies and dis-
sects them from one another. In general, the middle
is thus separated from the cellular coat, but in other
instances the blood advances by splitting the middle
tunic into two layers. In this manner a longitudi-
inal cavity is formed, terminating in a blind extremity or cul-de-sac. Such a condition was long ago described. It was observed by Mr. Nicholl as occurring in the body of George II, and a similar appearance was noted by Hodgson. In general but a small portion of the Aorta is affected, but in other cases the greater part of it. Saenoe has recorded a case in which it was so involved from the Arch to the bifurcation, and in a remarkable instance given by Mr. Jessier not only the whole Aorta, but also the Iliac a Popliteal, the Innomi niate and Carotids were more or less affected. The fissure usually extends across 1/3 or 1/2 of the circumference, but in some cases the whole circle of the vessel has been included, and the same observation applies to the extent of the separation of the vascular tunics in a transverse direction. In the Dublin Hospital Reports Mr. Shekelton described a peculiar, and till then unnotic ed, modification of this condition of the Aorta. In this, which is but an advanced form of the same variety of Aneurisms, the blood is not only incriminated between the Arterial tunics, but advancing between them regains the proper channel of the vessel by a second aperture at some distance further on upon its course. Of the few cases on record, of which this condition was established, some have presented the
old passage completely obliterated, the circulation being carried on entirely through the new channel, while in other instances both canals remained previous, and gave very much the appearance of there being a double aorta. On examination the new channel is found to present, not the rough surface, which we might anticipate from a separation of the vascular coats, but is smooth and bony-like, indistinguishable from the natural inner vascular membrane, and that this is an entirely new formation, we cannot reasonably doubt. A remarkably interesting case which well illustrates many of these several points, occurred in the Hospital Practice of Dr. Henderson: In it, the aneurysm extended from a little beyond the origin of the left subclavian artery to "an inch beyond the origin of the left common iliac artery." Both channels remained perfectly free, and "in fact so perfectly did the new one resemble an artery in its structure, that the aorta from the left subclavian to the iliacs, might be regarded, as having been converted strictly into a double artery." The arrangement of the tunics could be easily traced, and was peculiar: 1. The cellular coat was a common lining covering to both canals. 2. The middle tunic split into two layers formed on one side "the chief part of the thickness of the intima", and on the other
Supplied the place of a middle coat to the outer wall of the new channel. 3. "Each channel had a lining membrane of its own — that of the new being the thicker and firmer of the two."

It is a natural subject of inquiry, why the inner tunics having given way, in some cases an aneurismal sac, in others a dissecting aneurism, should be formed. While the former has been observed principally in the middle aged and chiefly in males, the latter, so far as our limited statistics can be depended upon, appears to be most frequent in advanced years, and most common in females. In nearly every instance it seemed to have been very rapidly produced. We must attribute its formation to the operation of one of two causes; either that the cellular tunic is in these instances permanently dense and unyielding, or that the vascular tunics are very loosely adherent to one another. The latter seems to be the more probable hypothesis, and it is supported in a measure by observation. In Dr. Henderson’s case, “the coats admitted of being detached with a facility not much less than that with which two pieces of moistened paper might be separated.” InLesseris of opinion that in the case of the formation of an aneurismal sac, effusion of blood between the tunics is prevented by adhesion.
inflammation having taken place between the outer and inner membrane, and that the dissecting aneurism is produced when the ordinary deposition of lymph in this situation has not taken place. So this it is sufficient to reply, that when a healthy aorta, in which no such postnatal adhesion could have existed, was forcibly distended by injection of water, at that part where the inner membrane had been previously divided the cellular coat was distended into an aneurismal sac. Dr. Peacock, however, it must be admitted, denies the validity of this conclusion, and cites some experiment of his own as indicative of a contrary result.

It is unnecessary in the present day to point out the great advances, which have of late years been made in the diagnosis of affections of the heart and large vessels, and to show the applicability of the general truth, to the detection of aortic aneurism. What our forefathers, and that at no distant date, could at the best but suspect, the enlightened physicians of the present day can often determine, with the most perfect accuracy. Though instances even now ever and anon arise which either elude his observation or baffle his skill. It must not however be imagined that this is an eminence, easy to arrive at. Far otherwise, there is perhaps no point in the wide range of medical drag.
mosis, which is to beset with difficulty, and none assuredly
which so loudly demands the most unrewarded industry and
persevering application, not only over the pages of Hope or
of Williams, but also and with infinitely greater profit
by the bedside of the Patient, where the disease itself
can be witnessed, its symptoms studied, the Physical
phenomena which it exhibits, carefully and laboriously
investigated. And if it be alleged that an improved
diagnosis profits little, when the Treatment is in no
way improved, when the fearful disease advances un-
checked as it did before, we can with truth reply that
the first step towards a rational treatment is an accu-
srate diagnosis; for not till we have the means of becoming
acquainted with the true nature of disease, and of
watching its progress, can we ever hope to satisfy our
minds as to the effects of remedies upon it. And if, as
is much to be feared, this affection should ever remain
beyond our control, it is surely no small benefit to be
able, by means of accurate data, on the one hand, to
calm groundless fears, and on the other to avoid every
thing which, the disease when it does undoubtedly exist
—is to be able to do all in our power to prolong a life,
which we cannot—to palliate the harassing symp.
toms of a malady, which we cannot cure.
But of the Diagnosis and Treatment of Aortic Aneurism I will not speak, nor yet will I enter upon the consideration of the Abnormal Conditions of this large vessel, a subject of no small interest, and which falls more properly within the limits which I have assigned myself. On this point I might have enlarged, and it was my intention to have done so, but the unexpected length of the preceding remarks preclude my entering upon the consideration of a subject of so great extent.

Appendix.
Appendix.

A. In Schmidt's *Jahrbücher* for 1849, a short abstract is given of a work on *Atheroma* by Sonders and Jansen who have made extensive researches on this interesting subject, and as the views which I have already advocated are very clearly and lucidly stated in this paper, I will give the translation of the greater part of it.

"Morbid Alterations in the Walls of Arteries and the Formation of Aneurisms, according to Special Researches—"

"In the inner surface of the Aorta, from its origin as far as its division into the two iliacs there are frequently found small round spots or narrow streaks, which lie in the direction of the stream of the blood, are very slightly raised from the surface of the artery, and present a yellowish white or yellow colour. A small portion from these spots shows under the microscope here and there groups of yellow coloured fat globules. On making a fine section, these are found to lie on the inner side of the unaltered inner membrane, and to be developed for the most part in the vicinity of the inner membrane. These spots, called by Piret "Taches Rudimentaires," and described by him as the first beginnings of the atheromatous formation, ought not to be considered as such.

"1. The laminated deposit on the inner surface of the arteries in its original form."
In diseased arteries, which at a later period display the formation of aneurisms, there occur on the inner surface more or less raised circular spots, from the size of a hemp-seed to that of more than several quarters of an inch, which, besides being reddened by the imbibition of the blood colouring matter, appear gelatinous and of a transparent faint white, and in addition the thickness of the deposit is considerable. In many places the adherent membrane becomes removed. A cross section of such an arterial spot, from which the membrane has been removed, appears from microscopic examination to consist of its normal elements. The inner membrane has its natural thickness, and is only brown or granular on its inner aspect. Thus this layer which has been removed is an abnormal deposit. This deposit is either closely united to the inner membrane, or easily separable from it. Sometimes it seems as if it consisted of thick elastic fibres. Thin fragments of it may be split up into fibres by tearing them with needles, and a fibrous appearance is also produced by breaking it down with the handle of the knife. These fibres probably lie in the longitudinal direction, once on the free surface of such a section, large masses of molecules appeared embedded in a gelatinous exudation.

In Acetic Acid the morbid deposit was much swollen out, while it also became clearer. In solution of Potash it was completely dissolved in 24 hours, and thus it is
distinguished easily from the inner arterial membrane.

"2. The transition of the deposit into friable softening (atheroma
atous formation) or into deposit of bone

"In the further course of the morbid process the spots appear
more intensely yellow, and, if you remove their most superficial
layer, you find that you have got a white cheesy, yellow
mass, soluble for the most part in Ether. It resembles an
abcess with its covering. On the removal of the softened
substance the arterial wall is found more or less rough.
Frequently the covering layer is already removed, so that
the spots assume the appearance of tumours, on which the
softened mass either sticks firmly, or has been already detached
off it. The parts of the cellular layer corresponding to these
places are thickened. As the softenings are broadened out,
the artery becomes widened, according to the form of the
morbid parts.

"More frequently at certain parts of the morbid deposit
triangular concavities—so called tony plates—are observed,
that present remarkable forms. The Microscope shows that
the soft masses consist of fat globules, a conclusion which
is established by the chemical reaction, as they are for
the most part dissolved in Ether, while little of them dis-
appears in Acetic Acid. Between the fat globules often
are Cholesteroline Crystals. In almost all the preparations
the formation of fat began at the past nearest the inner
"membrane, where the development of fat had gone on to a great extent, the inner membrane had become much thinned, while the outer for the most part was thicker than usual. At the parts where the softened material is entirely or partly abraded, a new pellicle of morbid deposit may be formed.

The formation of ossifications seldom occurs isolated. It is met with in the softened masses, and just as frequently deeply as at the surface. In reducing these plates to masses capable of microscopic examination, dark corpuscles are found in them, which are here and there accumulated into large masses, and from which in some cases distinct branchings proceed. These corpuscles do not disappear on being treated with oil of turpentine. Between them lies a spongy substance very much like finely punctuated tissue. After immersion in Muratic Acid much Cast. Anic Acid is given off from the plates. By longer treatment with diluted Muratic Acid the corpuscles entirely disappear. In the ossifications, which more resemble horn, these dark corpuscles occurred only in the friable margins of the plates.

3. Gradual destruction of the inner and middle coat
   with or without alteration of the outer.

In the commencement of the fatty formation the inner and middle arterial coats are completely normal, but
"When the peculiar kind of softening commences, then, not only in the deposit but also between the membranes, the formation of fat globules is seen, by which a gradual destruction of both membranes is brought about. That in fact the inner and middle coat are affected and destroyed by a fatty degeneration, is most evident, on making a microscopical examination of the above mentioned morbid product after it has been treated with ether. Here the outer layers of the neighboring sound parts are continued only at the base, while the layers which pass up to the margin of the morbid growth suddenly break off. In many cases the middle layer is completely destroyed, so that the bottom of the morbid growth is directly in contact with the outer coat. The outer membrane shows during the formation of fat a remarkable development. Sometimes it remains quite normal. At others the part corresponding to the atheromatous formation becomes remarkably thickened. The thickened layers show all the various phases of development of the elastic tissue.

4. Aneurism-formation—

"The less resistance arteries are able to offer, the more easily do aneurisms form, and the larger do they become. The capability of resistance must depend on the extent of the destructive process, and the amount of new elastic fibres formed in the cellular membrane. The form of
"The Aneurism must also be influenced chiefly by the above alteration, while an aneurism may even be altogether absent in spite of Atheromatous degeneration, provided the cellular membrane be sufficiently thickened. The results of the re. searches may in short be summed up as follows: 1. The Atheromas Rudimentaires are of very general occurrence; the Atheromatous formation is not produced from them. 2. The first morbid alteration consists in an irregular laminar deposit on the free surface of the Artery. 3. As new layers successively develop themselves on the inner aspect, fat globules are produced in the layers first developed. 4. The development of fat begins almost without exception in the neighborhood of the inner membrane. 5. While the development of fat extends towards the interior, the parts which are nearest the inner membrane pass into softening. 6. The softening gradually extends towards the interior without a corresponding deposition of new layers, so that the softened material at last becomes free and mixes itself with the blood. 7. The softened mass consists of fat globules, cholesterine crystals, and a granular substance in a fluid blastema. 8. By the softening the inner membrane is destroyed, and the middle more or less atrophied, even before the softened mass has become thrown into the blood-stream. 9. If at this period the outer membrane is not much thickened, a dilatation of the Artery results. 10. There occurs a
"removal deposit on the inner surface of the part from which the softened material has been removed."

As to whether the atheromatous formation and the process of ossification are to be regarded as two entirely distinct conditions, we must consider that while they have a similar origin, they are at the same time of a like nature. Violent controversies have arisen as to whether the atheroma deposit is the result of inflammation or is a direct deposit from the blood. The following circumstances support the latter doctrine: 1. The completely normal condition of the middle and inner coats in the commencement of the process - 2. The beginning of the metamorphosis in the layers next the arterial coat, which must on that account be considered as the oldest. 3. The conversion of the deposit into atheroma, and not into pus. 4. The observation that the layers of mortis deposit consist of aggregation of molecules. 5. The fibrinous condition of the deposit in the long direction of the vessel. As the deposit occurs only in arteries or in varicose aneurism, the arterial blood must be considered as the predisposing cause. The explanation of this must be sought for in an altered condition of the blood, which as yet cannot be exactly defined. The identity of atheroma and intima is so far from being proved that the two rarely exist together."
Appendix B

The following case well illustrates the occurrence of Hyper trophy of the Heart, as a consequence of Dilatation of the Aorta.

Alex. Edmonstone, aged 62. Silversmith. was a patient in the clinical wards, labouring under Dyspnœa, Anaœmicæ. He had suffered from cough, and shortness of breathing, more or less, for 20 years, but these had much increased during the few weeks preceding his admission, and his legs and abdomen then began to swell. He died on the 23rd Dec. 1851.

Autopsy 21 hours after death.

The Aorta was very much dilated throughout its whole extent, but chiefly in the arch. When slit up, it measured 3 inches in breadth immediately above the valves, and gradually increased in width, till below the origin of the Iliaca, where it was 4 inches. The Aortic Valves were almost quite incompetent, but were found upon their sides slowly pass through the Mitral Valves quite healthy. The Heart was much enlarged, weighing with the Aorta 1 lb. 11 oz. The Aorta was thickened throughout with Atheromatous patches and Calcareous plates. There was but very slight Emphysema.