

Thomas Miller

1853

Thesis by J. Miller
on
Aneurism

An aneurism is a pulsating tumour containing fluid and coagulated blood within its cyst, which communicates with the canal of an artery.

Aneurism may be spontaneous or the result of injury, and they are commonly divided into True and False. The former are those in which one or more of the arterial coats remain entire; in the latter all the coats have given way, and the cyst is formed of the sheath of the vessel, or of the condensed cellular tissue surrounding it.

When the vessel is dilated for some way, so that the tumour is oblong and gradually loses itself in the surrounding tissues, and you cannot very well make out its margins, it is called a diffused true aneurism; but when it has a determinate border, it is called a circumscribed true aneurism. Also in false aneurism when the blood by pressure causes the cellular tissue to form a sac around it, the tumour is called

called

called a circumscribed false aneurism; but when the blood escapes into the cellular tissue it is diffused. These two terms are also applied to aneurisms according as they have got a true cyst or not.

True aneurism may be formed in various ways.

I. By dilatation. This happens very often in the Aorta. The coats are dilated to a greater or less extent, and steatomatous deposits are often seen in them.

Fernelius was the first who considered the dilatation of the coats of the arteries, as the proximate cause of aneurisms, especially, internal ones, which had no evident cause for their origin. Scarpa showed that there was only one form of this disease; viz, that caused by rupture. He says "I have ascertained, in the most certain and unequivocal manner, that there is only one kind, or form of this disease; viz, that caused by a solution of continuity, or rupture of the proper coats of the artery, with effusion of blood into the surrounding cellular substance; which solution of continuity is occasioned sometimes by a wound, a steatomatous, earthy degeneration, a corroding ulcer, a rupture of the proper coats of the artery, I mean the internal and muscular, without the concurrence of a preternatural dilatation of these coats being essential to the formation of this

Aneur

disease; and, therefore, that every aneurism, whether it be internal, or external, circumscribed, or diffused, is always formed by effusion." Aneurisms are sometimes met with, however, where no solution of continuity can be perceived in the walls of the artery.

The dilatation may only be on one side of the artery, in which instance, the hollow swelling which is formed is said to be Sacciform. Or the artery gradually dilates in its whole circumference, and gradually falls down to its natural size, thus forming a spindle shaped swelling, to which the appellation of Fusiform is given. Also the dilatation may end abruptly and equally, and then it is called Cylindroid.

II. By dilatation and rupture.

Sometimes the disease commences in the dilatation of a portion of the circumference of an artery.

This dilatation increases until the coats of the vessel give way, when the surrounding parts form the sac, in the same manner as when the disease is in the first instance produced by destruction of the coats of an artery. In this form of aneurism all the coats are at first dilated, but subsequently the internal and middle are broken from some cause, such as ulceration, or on the occurrence of some sudden strain. In consequence of the breaking up of the inner coats
blood

blood passes through the rent, and by its pressure distends the outer, which forms the sac of the aneurism. This sac gradually distends because of the impulse received from the blood, and its walls are strengthened on the outer side by the condensation of the surrounding tissues, which is caused by the gradual distension of the sac, and inside by fibrine being deposited from the blood. The condensation of the tissues surrounding the aneurism acts as an obstacle to the further enlargement of the sac, as well as adding to the strength of its walls.

III. By Rupture.

This kind is formed rapidly and generally results from some sudden strain, by which the coats of the artery are stretched beyond what they are able to bear. The subject of the disease is generally warned of it by the feeling of something having given way. Besides there is generally a atheromatous degeneration of the arteries which acts as a predisposing cause.

There are different names applied to different varieties of true aneurism.

When the coats of the artery are separated from one another to a greater or less extent by the infiltration of blood the term Dissecting is applied. Most commonly the transverse fibres of the

Middle

middle coat are divided into two layers, but the two inner coats may also be separated from the external. It is called partial when the space between the coats ends without communicating with the artery, and complete when it does so.

This variety is generally found in the aorta.

II. The inner coat may alone remain entire.

In this sort the external and middle coats having given way the internal is protruded. This was formerly denominated mixed aneurism. It is of rare occurrence in true aneurism.

III The middle coat only may have given way.

IV. Pedunculated aneurism. This is an aneurism which is connected to the artery by a narrow portion of some extent, instead of being immediately joined to the vessel. In consequence of the peduncle the tumour may be felt at a considerable distance from its origin, and may be mistaken for an aneurism of some other vessel.

The false aneurism is always owing to an aperture in the artery, through which the blood flows into the cellular tissue. It may arise from an artery being lacerated in violent exertions; but the most common cause is a wound. It may also be occasioned by the burrowing of an abscess near

near an artery so as to cause perforation of its coats by sloughing. False aneurism is very apt to occur at the bend of the arm, when the artery has been wounded in attempting to bleed. The surgeon usually endeavours to stop the hemorrhage by pressure, and a diffused false aneurism may be the result. The wound in the skin is closed up so that the blood cannot escape through it; on this account it forces its way into the cellular substance.

The swelling thus formed is uneven, may be knotty, and generally extends up and down the arm in the course of the vessel. The circumscribed form may arise in the following way. When pressure has been applied properly to the part at first, so as to arrest the hemorrhage, but the means used for pressure having been removed either too soon, or before the wounded artery has had time to heal completely, the blood passes through the un:closed breach, or that which it has burst open again, and slowly accumulates in the cellular tissue. This tissue, which has been condensed by the pressure formerly made, resists the entrance of the blood into its cells, and consequently it is collected into a mass in the vicinity of the artery, and distends the cellular tissue into a sac.

This sac is strengthened, as in true aneurism, by deposition of fibrine from the blood, and by the tissues surrounding it. The interior of the sac also becomes lined with a membrane, which appears to be continuous with, and similar to, the internal coat of the artery. Circumscribed false aneurism may also originate immediately after the artery is wounded. This usually happens when the aperture in the vessel is small, and, consequently the hemorrhage takes place so slowly, that the blood first effused coagulates, and prevents the entrance of that which follows into the cellular tissue, and thus its diffusion. A fascia or aponeurosis may also lie immediately above the orifice so as to prevent the aneurism from becoming diffused.

Some consider that this form of aneurism may arise from the membrane, which occupies the breach of continuity in the walls of the artery, being pushed out by the pressure of the blood within, and gradually distended so as to form the sac.

Symptoms. The first thing the patient usually perceives is an extraordinary throbbing in some situation, and, on drawing his attention to it, he discovers there a small pulsating tumour, which entirely disappears when compressed, but returns as soon as
the

the pressure is removed, with a whizzing noise, and thrill:
ingful. When once the tumour has originated, it grad:
ually grows larger, and, at length, attains a consid:
erable size. In proportion as it becomes larger, its pul:
sation becomes weaker, and when the tumour has
reached a good size, there may be almost none.

The pulsation is synchronous with the heart's impulse;
equal on all sides of the tumour; increased by pressure
on the distal side, and diminished by pressure on the
cardiac side of the tumour. There is also fulness of
pulse, coldness, numbness, and weakness of the parts be:
yond the disease, oedematous swelling and pain, owing
to the pressure of the aneurism on the veins and nerves.

There is also a bellows murmur heard on applying the
stethoscope, or the ear, to the tumour. This murmur, how:
ever, cannot be considered as peculiar to aneurism, for
it may be produced by the stethoscope, or any tumour, press:
ing upon an artery. It may also be sometimes heard
when there is no disease of the artery, and seems to depend
upon anaemia. When the aneurism is in the chest, these
signs will not always be recognizable, and will be
principally known by an unnatural pulsation felt
by the patient, and detectable by the stethoscope; there
will also be symptoms of disordered circulation and
respiration. It may also press upon the trachea so

as to threaten asphyxia, or upon the oesophagus, when the patient may die of starvation.

Pathology. The formation of aneurism is preceded by some disease of the artery. Sometimes the middle or fibrous coat, becomes opaque, yellow, and thin; sometimes it degenerates into a fatty substance; and a soft atheromatous matter is deposited upon it; this, according to Mr. Sullivan, displays under the microscope earthy and albuminous particles, oily globules, and crystalline plates and scales; and is principally composed of cholesterine. At the same time the lining membrane often acquires considerable thickness and hardness; in consequence apparently of an effort to compensate for the weakness of the middle coat. Or, there may be a deposit of brittle calcareous matter, composed of phosphate of lime, in the substance or on the outer surface of the inner tunic. This earthy matter may be deposited in spots, scales, rings, or projecting spiculae. It is very common in the arteries of people advanced in life; but it does not appear, that this is so often the cause of aneurism, as the soft atheromatous deposit.

The ultimate effect of these atheromatous deposits is to impair the elasticity of the artery, and they may also cause ulceration or absorption of the
Coats

coats of the artery. The disease may be present without any appreciable deposition in the coats, but a diseased state of the internal coat is usually visible.

Soon after the formation of an aneurism, fibrin is deposited from the blood, which lines its interior in concentric layers. This deposition of fibrin may be ascribed to the morbid condition of the coats themselves, or to the slowness of the circulation of the blood in the tumour, owing to its being diverted from its proper channel. Those layers which are first deposited are firm and of a pale yellowish colour, and the more recent the deposit, the softer and the more red it is. This deposit is always seen in true aneurism when it has existed for any length of time however small it may be. The fibrin never becomes organized, and the insinuation of the fluid blood between its layers is the invariable precursor of the bursting of the aneurismal sac. From the commencement of the dilatation of the vessel, an exudation of lymph takes place from the internal coats around the edges of the opening, and this thickened edge is generally well defined. Its formation is a provision of nature to limit the extension of the disease. The communication between the artery and the sac is at first oval, but as
the

the disease advances it becomes irregular, and in some cases the artery may be entirely divided by it. Aneurism has a tendency to extend towards the surface, whence the blood escapes externally, or it may advance to some internal cavity or outlet. When it reaches the surface the skin becomes thin and discoloured, and ultimately a portion sloughs away. Around the margins of the slough the coagulum begins to protrude and the blood to ooze away, but more frequently the patient is at once carried off by a sudden hemorrhage.

Causæ. The predisposing causes have been ascribed variously to be, Scrofula, Syphilis, Mercurial affection, Rheumatism, Gout, and the too free use of ardent spirits. Such may be the ultimate causes, but the proximate are such as would produce rupture of the coats of the artery, as violent exercise. It appears that hard working men, accustomed to partake freely of ardent spirits are the most frequent subjects of the disease. The curvatures of the arteries and their points of division are the most frequent seats of Aneurism. There is one artery of moderate size, however, which is more subject to Aneurism, than other vessels of much larger diameter: viz. the Popliteal

The crural, of which the last is merely the continuation is much less affected. The cause of this frequency of aneurism of the popliteal is accounted for differently by Richardson and Pelletan. The cause is imputed by Richardson to the situation of the artery in the ham, at the back of the knee joint, an articulation, of which the extension is only limited by the resistance of such tendons, ligaments, and soft parts as are placed behind it. In the stretching, he says, to which all the parts are subjected, behind the joint, when the leg is forcibly extended on the thigh, the artery, whose texture is the slightest, is particularly apt to be lacerated.

Pelletan's explanation is somewhat different— He says, that, of the two principal motions of the knee joint, viz. extension and flexion, the first of these is so limited, that it is actually an incipient flexion, produced by the curvature backwards both of the condyles of the femur, and those of the tibia. This curvature which would seem to protect the popliteal artery against any dangerous elongation, that might otherwise be caused by a forcible extension of the joint, becomes the very source of such an elongation in persons, who are accustomed to keep their

their

their limbs bent, or, who, from this state, proceed hastily and violently to bend the leg. The arterial tubes are really shortened, when the limbs are in the state of flexion, and lengthened, when the extension of the members renders it necessary.

Hence, he says, it is manifest that a habitual shortness of state of these vessels, and their sudden elongation, must be attended with hazard of rupturing their parietis. The arteries, which, after the aorta and popliteal, are the most frequently affected, are the crural, common carotid, subclavian, and brachial arteries. The temporal and occipital arteries, and those of the leg, foot, forearm, and hand, are much less frequently the seat of this disease. The causes of aneurism operate either by impairing the strength of the arterial parietis, or by increasing the lateral impulse of the blood against the sides of the vessels. It is said to be in both these ways, that the disease is occasioned by violent contusions of the arteries, the abuse of spirituous liquors, fits of anger, rough exercise, mercurial affection, etc. In certain persons, also, there appears to be a peculiar organic disposition, an Aneurismal Diathesis, in which aneurisms may be found

in different parts of the body at the same time. Aneurisms, and diseases of the coats of arteries, which lead to aneurism, are much more frequently met with in men than women. Mr. Hodgson gives the following table, shewing the comparative frequency of aneurisms in the two sexes in different cases of this disease, and also in the different arteries of the body.

	Males	Females	Total
Of the ascending aorta, the arteria innominata, and arch of the aorta	16	5	21
Descending aorta - - - - -	4	1	8
Carotid artery - - - - -	2		2
Subclavian and axillary - - -	5		5
Inguinal artery - - - - -	12		12
Femoral and Popliteal - - - -	14	1	15
	56	7	63

This table does not take into account aneurisms from wounds, nor aneurisms by anastomosis.

In men it most frequently occurs in the lower half of the body. in women in the superior half.

The period of life in which it is most frequently met with is from 25 to 50. It has occurred, however, below this age, even under puberty.

It has been noticed, that portilions and coachmen, who sit much with the knees bent, are subject to popliteal Aneurisms.

The distinguishing characters of circumscribed true and false aneurism are generally described as the following; - True aneurism quickly diminishes on the application of pressure, and it reappears almost as soon as the pressure is removed; false aneurism only disappears gradually, and returns slowly after pressure has been taken away, because the blood can only pass slowly from the sac into the artery, and from it again into the sac.

The disappearance of the bulk of a true aneurism will depend materially upon the stage at which it has arrived; if the aneurism be recent and there be little or no coagulum inside, the tumour will disappear readily on the application of pressure to the cardiac side; but the diminution in size becomes less and less, in proportion as the tumour increases in size, so that, in a large aneurism there is comparatively little diminution in size, though the circulation be stopped.

A distinct round is often observed when the blood flows again into the sac. The pulsation is weaker in false than in true aneurism, and sooner becomes indistinct in the enlargement of the swelling. This will also depend upon the period and the extent occupied by the blood which has escaped,

escaped, and is proportionally less the greater the quantity of blood thrown out.

The aperture by which the sac of the false aneurism is connected with the cavity of the artery is narrow in comparison with its base: in partial extension of all the arterial coats, the entrance of the blood is just as wide as the base of the sac.

When the extension occupies the whole tube of the artery, the swelling is always cylindrical or egg-shaped, yields easily to pressure, and in the dead body is found always smaller than it was during life.

The form of the false aneurism is irregular and continues the same in the corpse. The external form of a false aneurism is irregular, as it depends upon the looseness of the surrounding cellular tissue, and whether the part be or be not enveloped in a tendinous sheath; but the immediate sac consisting of more or less layers of coagulated blood, which, as they continue to form, thrust the cellular tissue away from the artery, and hollow it out for their own lodgement, is generally of a regular oval form.

In the sac of a true aneurism, layers of coagulated blood are never deposited, which is always the case in false aneurism, with very rare exceptions.

That layers of coagulated blood are never deposited in a true aneurism, is incorrect where the aneurism results from ulceration, or tearing of one or other of the coats of the artery; for very soon after a pouch is formed, layers of coagulated blood are deposited. The more all the coats of an artery are expanded the more they are thinned, whilst, on the contrary, the sac of a false aneurism increases in thickness. As to the difference of thickness of the sac of the true and false aneurism, although in the former, the coats of the artery thin, as the disease increases, yet there is a continuous slow inflammatory action going on upon the external surface of the sac, by which its thickness is preserved, till the parts, by which it is surrounded, having either been absorbed or stretched to bursting by its size, the sac itself is the only remaining resistance to the impulse of the blood, and it in its turn thins, yields, and at last bursts. The thickening of a false aneurismal sac continues as long as the surrounding cellular tissue confines and supports it, but when the tissue is absorbed or sloughs, the sac thins, yields and bursts as the true aneurism does.

Diagnosis of aneurism from other tumours.

I. From various tumours, especially those containing fluid

fluid situated over an artery,

II From tumours of great vascularity, as the Medullary, having a regular pulsatory movement and equally expanding. Aneurism has been mistaken for an abscess and opened. Aneurisms can generally be distinguished from these by observing: I That aneurisms are soft and can be compressed from their commencement, and that they afterwards become hard from the coagulation of the blood within, whereas an abscess generally begins with hardness and afterwards softens.

II. That tumours do not pulsate at first when small, but aneurisms pulsate from their very commencement.

III. That tumours may be lifted up from the artery, but it is impossible to do so with an aneurism.

IV. That aneurisms of the large arteries have generally a double impulse; the first corresponding to the diastole of the heart, the second to the systole; whereas tumours which receive merely arterial pulsation give only one impulsion, isochronous with the diastole.

V. That tumours cannot be emptied by pressure and that no alteration can be made in them when you compress the artery above, but if you press on the cardiac side of an aneurism its pulsation, size,

and

and thrill, are diminished, and if you press on the distal side just the reverse happens. A tumour can only have its apparent pulsation affected in the same way. The compressibility and the pulsation of aneurism are the most characteristic marks. The stethoscopic indications are not to be relied upon, as the "bruit de soufflet" may be absent when there is an aneurism, and present when there is none. Enlarged lobes of the thyroid gland may be known from aneurism by taking hold of them during the act of deglutition, when they will slip out of your hand - an aneurism will not.

Proas abscep. may be known from aneurism by the pain and weakness of the back before the tumour formed, and by its disappearing when the patient lies down. Pulsating tumours composed of ductile tissue, or of malignant growths, more especially those connected with bone, are sometimes taken for aneurisms; from which it is difficult to distinguish them, as they have the same kind of pulsation, which is accompanied with the same kind of sound, and is checked, as that of aneurism is, by pressure on the cardiac aspect of the tumour.

The history of the case will also give you some notion as to whether the tumour is an aneurism or not.

Prognosis. In cases of aneurism the prognosis varies according to a variety of important circumstances. The disease may generally be considered as exceedingly dangerous: for, if left to itself, the aneurism enlarges, its coats become thinner, but are strengthened by the adhesion of the neighbouring parts. As it enlarges these are gradually absorbed and at length it reaches the surface and distends it. Inflammation and sloughing succeed and when the sloughs separate a fatal bleeding takes place; sometimes in a gush so as to cause death at once, but more frequently the blood oozes slowly away. It may open in the same manner into the oesophagus, trachea, etc. When the blood enters the trachea it may cause death by suffocation; or it may cause death through pressure on the trachea or oesophagus; or through pain and irritation, the system sympathizing with the local disease. Also inflammation may attack the sac and surrounding parts, and suppuration and abscess may follow, thus causing death. This is of rare occurrence but still there are examples of it.

Every external aneurism situated so close to the trunk that it cannot be compressed, nor tied above the swelling is for the most part not curable. But it should be remembered, that, from the rise of
the

the tumour, there may appear to be no ligature, while it may be the opposite, the communication between the sac and artery bearing no proportion to the size of the tumour itself. There are very few external aneurisms which cannot be assisted by surgery. Necrosis or caries of the bones is a bad complication, but Mr Hodgson says these affections of the bones are hardly ever attended with exfoliation, or the formation of pus, so that if the aneurism be cured the bones get well again, without going through the same process as they do in the case of caries or necrosis under other circumstances. The age, constitution, and health of the patient are also to be considered, as the success of the operation may depend upon them. Not unfrequently there is more than one aneurism at the same time; it therefore becomes a matter of great importance to make a careful examination of the whole of a patients body upon which it is proposed to operate; for if there be any internal aneurism, it is useless to subject him to an operation from which he can derive no lasting benefit, as the internal aneurism will sooner or later destroy him. Also the excitement of an operation may cause the bursting of an internal aneurism, as in a case that happened to Sir A. Cooper.

Sometimes many aneurisms are met with in the same person. Sir A. Cooper tied the external iliac artery for an aneurism at the origin of the profunda, and another in the middle of the thigh; the patient died afterwards of an aneurism at the bifurcation of the aorta, which burst into the abdomen.

"Upon examination," he says "an aneurism was found in each ham, one at the origin of the arteria profunda, one in the middle of the thigh, and two between the popliteal and femoral aneurisms, making in all seven. Tyrrel also mentions another case where there were seven. Pelletan mentions a case where he counted sixty three in one man, from the size of a filbert to that of half a pullets egg; and in a case related by Cloquet "all the arteries were studded with aneurismal tumors: some from the size of a hemp seed to that of a large pea; some were on the aorta and its principal divisions, but they projected little and were much less numerous than on the arteries of the limbs, where on many parts of their length they formed kinds of necklaces; all the swellings were numerous and close together. Those of the lower limbs were perhaps less numerous; without exaggeration they might be estimated at several hundreds".

Although there be more than one aneurism of
the

the extremities, the operation may be performed but at separate times.

Spontaneous cure of Aneurism.

Although this disease, if left to itself, almost always destroys the patient, sooner or later, yet, a cure is sometimes effected by nature; and an aneurism which cannot be treated by surgery, does not invariably terminate fatally. The spontaneous cure may be brought about in various ways.

The most frequent mode in which it is effected, is by the sac becoming filled with a coagulum. This was first minutely described by Mr Hodgson. The blood deposits upon the inner surface of the sac a layer of coagulum; and successive depositions of the fibrous part of the blood by degrees fill up the cavity of the tumour. At length, the sac becomes entirely filled with this substance, and the deposition of it usually continues in the artery on both sides of the sac as far as the giving off of the next large branches. The passage of the blood through the vessel is thus prevented, and the circulation of the limb is kept up by the collateral branches; and in consequence of the process of absorption being set up, the tumour becomes smaller and harder, and, in the course of time, may be altogether removed. Sometimes, instead of the artery

artery being obliterated, it remains pervious, the blood passing over the closed up sac at the part where its mouth communicated with the artery.

In some cases where the aneurism occupies the whole of the circumference of the vessel, a cure has been spontaneously effected by a canal being left in the middle of the coagulated blood, through which the circulating blood continued to pass. This seems to be a rare occurrence.

Inflammation of the sac and surrounding parts may be set up from some cause or other, and gangrene may supervene, the whole of the aneurismal sac sloughing away, thus effecting a cure; in this case, hemorrhage is prevented by the same process which occurs in other parts where gangrene takes place.

A cure may also be effected by the aneurism pressing on the vessel on the cardiac or distal side of the tumour, so as to prevent the circulation going on. If the tumour cause the sides of the vessel to come into contact, either on the cardiac or distal side, a cure will be the result; when the tumour presses on the cardiac side, a cure may be accomplished, by its pressure lessening the force of the circulation through the aneurism, in the same way as it is done by compression as now practiced.

Pressure on the trunk of the artery may also be produced by other tumours than the aneurism itself, as also
by

by an aneurism on a neighbouring vessel. Mr Liston records a case where an aneurism of the subclavian artery was on dissection found to have been cured by an aneurism of the innominate artery.

When inflammation attacks the vessel itself, and shuts up its canal with coagulum, a cure may also be effected. Sometimes, a portion of the laminated fibrinous coagulum becoming separated, gets into the sac, and may cause diminution or occlusion of the mouth. In the first case the diminution of the circulation through the sac is the consequence, and thus is favoured the deposition of a fibrinous coagulum - and in the second, coagulation of the blood within the sac takes place, and so a spontaneous cure is favoured. Or a portion of the coagulum may fall into the artery itself, and the same result supervene. This spontaneous cure may also be caused by the aneurism bursting and becoming diffuse.

If the infiltration of the blood into the surrounding tissues do not cause inflammation or gangrene, it may, by its pressure on the cardiac side of the tumour so lessen the force of the circulation through the aneurism, as to promote the deposition of fibrin, or arrest the circulation of the fluid contents of the sac, and thus promote their coagulation.

Treatment. This is divided into Medical & Surgical.
Medical. This is the only kind of treatment which can be resorted to when the aneurism is in the cavities, or beyond the reach of surgery. It is conducted on the principle, that the diminution of the force and velocity of the blood increases its tendency to coagulate. This is accomplished by lowering the action of the heart, and lessening the quantity of the circulating fluid itself. For this purpose Balsaiva and Albertini proposed and practised the employment of the antiphlogistic treatment to such an extent as to be scarcely compatible with the continuance of life. They reduced their patients to such an extreme degree of debility, by repeated small bleedings, that they could not get out of their beds.

They kept them in the horizontal position, enjoined quiet and almost starved them. When by this treatment a cure was accomplished it was by favouring the deposition of a fibrinous coagulum.

Balsaiva, Albertini and Pellitan have recorded cases of cure by this method; but it is thought that its good effects have been overstated.

This mode of treatment can scarcely be enjoined so strictly as they require, and, although it could be practised, it is thought that, in some persons, it might induce other diseases, and so prove hurtful.

It is employed now in a much less severe form, in hopes not of curing the disease, but of checking its progress. When aneurism is beyond the aid of surgery it is advisable to employ this treatment. The patient should be restrained from all exciting causes, as too violent or long continued exercise, etc., the diet should be restricted, little or no animal food given, or other stimulating substances. The patient should guard against all emotions of the mind, and blood should occasionally be taken from the system, in accordance with the force of the circulation and strength of the patient. The blood should be withdrawn slowly and with the patient in the horizontal posture, and a large quantity should not be taken at a time, for fear of bringing on syncope, which, in internal aneurism, is attended with considerable danger. Antispasmodics are also employed, especially Tincture of Aconite. Digitalis is also given for reducing the heart's action. This kind of treatment is only palliative. Astringent remedies have also been employed for the purpose of restoring the elasticity of the arterial coats, or for effecting the complete coagulation of the blood in the sac. These consisted of applications of cold water, pounded ice, oak bark, etc. Guérin, of Bordeaux, appears to have been the first that proposed the application of iced water

water, or pounded ice, to the aneurismal sac; and, though there appears to have been some doubts as to the beneficial use of these applications, Richerand says, that subsequent observations have proved the advantage of pounded ice in the treatment of aneurism, and that the examinations of the bodies of persons cured in this way, have dissipated all doubts as to the value of this remedy. And he mentions a case reported in the Bulletin de la Faculté de Médecine de Paris, No. 4, 1812, in which a popliteal aneurism was cured in this way. Hodgson, again, says that he has seen ice applied to a large inguinal aneurism, but it produced such excruciating pain that its employment was from necessity discontinued.

If this mode of treatment has cured the disease, it may have been in part due to the compression caused by the applications, and the patient being kept in perfect rest.

Surgical Treatment. The spontaneous cure of aneurism is rare and should not be trusted to when we have the means of curing it by surgery.

In the time of Celsus the practice was to open the tumour, to clear out its contents, and endeavour to stop the hemorrhage by the actual cautery, an operation which was very frequently fatal. Rufus practised another operation. He first applied a ligature to the artery above the aneurism, and then laid the tumour open

open and cleaned out its contents. Antyllus performed this operation with the modification of a ligation being applied to the artery below the tumour as well as above it. These operations were succeeded by one which was both more dangerous and formidable. It consisted in laying open the tumour, cleaning out its contents, and then applying a ligature to the artery above and below its opening into the sac.

Crattani opened the sac, removed its contents, and applied pressure to the artery at the point where it opened into the sac. Some surgeons at this time besides using compression employed styptics along with it.

The surgical cure of aneurism consists in the obliteration of the cavity of the artery communicating with the sac, so that the blood is entirely prevented entering the sac; or in lessening the force of the circulation through the sac, so that the tumour is hindered from increasing in size, and the disposition of coagulation is increased. By the absorption of its contents and the gradual contraction of the sac, a cure is after a time accomplished. The blood is carried on to the parts, which it is destined to supply, by the neighbouring vessels, some of which being gradually enlarged, carry on the circulation in those parts

as well as the principal vessel did before obstruction.

The means used for the purpose of curing aneurism are compression and the ligation.

According to Scarpa, a perfect cure of an aneurism cannot be accomplished, in whatever part of the body the aneurism is placed, unless the artery, on which the tumour is situated, be obliterated and converted into a perfectly solid ligamentous substance, above and below the place of the ulceration, laceration or wound.

He says whenever the ulcerated, lacerated or wounded part of the artery, is accurately compressed against a hard substance, as bone, it no longer pours forth blood into the surrounding cellular sheath, in as much as its sides, being, for a certain length of time, kept in firm contact both above and below the breach of continuity, become united by the adhesive inflammation, and converted into a solid ligamentous cord.

In order that pressure may cause the opposite walls of an artery to adhere and produce a perfect cure of an aneurism, Scarpa says, that the degree of pressure must be so great as to place the opposite sides in close and firm contact, and such as to excite the adhesive inflammation in the coats of the artery. The point of compression must also fall above the aneurism, as when it is placed below, it hastens the enlargement of
of

of the tumour, and he also mentions, that in practice, bandages, which are expulsive and compressive, are more useful in making pressure, than any tourniquets or instruments, many of which are contrived to operate, without retarding the return of blood through the veins. That pressure may succeed the coats of the artery must have, at the point of compression, such a degree of vitality, as to be able to feel the stimulus and to inflame. When the arterial coats are diseased they are not capable of being made to inflame, although pressure be made.

Guattani first employed pressure systematically for the curing of aneurism, and has related many cases where he succeeded; but sloughing, ulceration, or suppuration, with great constitutional disturbance followed more frequently than a cure, from the imperfect and often violent manner in which it was applied. It was the unsatisfactory results of the treatment of aneurism by tying the affected artery above and below the sac, and the opening and emptying of the latter, either before or after the ligatures were applied, that led him to consider of some other means for the cure of this disease. In 1765 he tried to cure a popliteal aneurism by bandaging, and, perhaps, that by patients and assiduous use of this treatment, he was delighted to find that the swelling, although it constantly preserved its

its hardness and pulsation, daily decreased more and more; so that after three months, he had the pleasure of seeing the patient leave the hospital perfectly cured.

To secure the obliteration of the artery various plans were proposed by different surgeons. The following was recommended by Mr. Freer: a moderately tight bandage is first to be applied to the whole limb; a pad is next to be placed over the artery a few inches above the tumour, & then a tourniquet round the limb, the screw of which is to be fixed upon a pad. Care must previously be taken to secure the limb from the action of the instrument by a piece of board wider than the limb itself, by means of which the artery only will be compressed when the screw is tightened. The tourniquet should now be screwed up till all pulsation in the tumour ceases; in a few hours the limb will become oedematous and swollen, when the tourniquet may be removed, the pressure of the pad and bandage sufficing for the remainder of the treatment. This process was found to obliterate the radial artery of horses, but was not very successful when applied to the human subject. Sir A. Cooper and Sir W. Blizard also used instruments of a particular kind, but the results were no better. The reason of the want of success was not so much owing to the compression itself, as to the erroneous principles

principles on which it was conducted; their object being, in all these cases, to effect a cure in the same manner as when the ligature is applied to the vessel, viz, by its obliteration at the point compressed.

In order to accomplish this, it was necessary to keep up powerful and long continued pressure on one spot, the inevitable result of which was the occurrence of insupportable pain, ulceration and sloughing of the parts compressed, and great constitutional disturbance. The mischief caused by this plan was such that it was quickly set aside for the more certain and less painful operation by the knife. The employment of pressure having thus been given up, there was nothing heard about it, until it was revived by Dr Hutton in 1842. The good results which have attended the revival of the employment of pressure to the artery on the cardiac side of the tumour, seems to be owing to its mode of action being properly understood, and it now being recognised that the degree of pressure necessary for bringing about the cure of the disease, is not nearly so great as that which is required for the obliteration of the canal of the artery. It would appear that it is not at all essential that the circulation through the vessel leading to the aneurism, should be completely stopped, but the contrary.

The object which is sought to be brought about by the use of compression as now practised, is the coagulation of the blood, and the formation of a fibrinous deposit in the aneurismal sac. The flow of blood through the tumour being very greatly lessened, the fibrine is more readily deposited, and successive depositions taking place, the sac is at length completely filled, the tumour becomes solid, and the pulsation in it ceases. As no blood can pass any longer through the sac, the circulation is carried on by the collateral vessels, which have been gradually enlarging, in accordance with the obstruction in the sac. Since the revival of compression great improvements have been made in the kind of instrument used. That employed by Bellingham was invented by a patient of Dr. Harrison's whilst under treatment for popliteal aneurism, and is something like a carpenter's clamp. It consists of an arc of steel covered with leather, at one end of which is a splint well padded, the other extremity having a nut and screw, to which a pad like that of the tourniquet is fastened. The instrument used by Mr. Liston was something of the same kind. In order to avoid any excoriation or choughing, or in case the vessel should get from beneath the pad, it should not be of too conical a form. Mr. Liston found

found much advantage in protecting the integuments covering the artery with a piece of soap plaster spread on leather, and the outer part of the limb with a splint of strong leather, for the external part of the instrument to rest upon; thus removing all direct pressure from the soft parts, and diffusing it over a greater extent of surface. Two or three instruments have also been employed ~~at the same time~~, which are placed upon the artery leading to the aneurism, only one at a time, however, being tightened. When the pressure of one of them becomes painful, it is slackened, one of the others having previously been screwed tight. In this way the pressure may be alternated and continued uninterrupted for any length of time, the patient being able to make the change on the tourniquets as he finds most convenient to himself.

There will also be no time lost by the parts subjected to pressure being excoriated, or ulcerating, from the pressure of the pad of any one of the instruments being too long continued.

Treatment by compression is only applicable to aneurisms of the extremities, below the groin or axilla. The length of time during which it is necessary to continue compression is variable. In one case 2 days effected a cure; in another five months failed to produce any beneficial effect. Six weeks is considered the average time required.

Compression may be useful while the aneurismal tumour is yet small, as, by diminishing the force of the circulation, it may favour coagulation and obliteration of the sac.

Also when the coats of the artery are unsound, and on this account would not bear a ligature, compression may be tried as affording a chance of cure. It will be proper, however, to use the ligature, when the tumour is enlarging rapidly, when there is a tendency to venous congestion in the limb, or when the patient is of an irritable constitution.

The operation by which a ligature is applied to an artery for the cure of aneurism goes by the name of the Hunterian operation. This operation consists in laying bare the artery above the aneurismal tumour, and applying a ligature between it and the heart.

This operation was first performed by Hunter in 1785, in St. George's Hospital, London, for the cure of a popliteal aneurism, when he tied the femoral artery.

And before him performed an operation by applying a ligature to the cardiac of an aneurism, but in this case the ligature was applied as close to the tumour as possible, and for the cure of a false aneurism.

This operation of Anell was performed on the brachial artery of a friar, which had been wounded in section, but which did not bleed till the 15th day after the injury, when it was checked by the use
of

of astringents and bandage. He performed the operation on the 30th January, 1740, and he gives the following description of it: "having made myself master of the blood (he says) by means of a tourniquet, I made an incision in the integuments, without touching in any way the aneurismal sac: I then sought for the artery, which I found situated below the nerve, which is not common.

I took every precaution in separating it from this, and having lifted it upon a hook, I ligatured it as near to the tumour as possible. The artery having been tied, I loosened the tourniquet, when a small muscular branch, which I had divided in dissecting the vessel, bled and compelled me immediately to tighten the tourniquet, and to tie the artery again a little higher up; the tourniquet being loosened, I saw no more bleeding, nor any pulsation in the tumour. The first ligature separated on the 17th February; and the second on the 24th of the same month, without the superintention of the least hemorrhage.

On the 1st March of the same year, this friar not only left his room, but even went to church."

At the time when the Hunterian operation was first performed, the proper method of applying a ligature was not understood, and to guard against hemorrhage, various plans were tried. Some had ligatures of reserve, the ligature being tied in a loose manner to prevent

prevent the too early division of the arterial coats; some used pieces of tape, and bundles of thread for ligatures, and sometimes they introduced substances between the artery and ligature. As the operation is performed now, the ligature is applied to the artery not so near the aneurism, as to run any danger of being placed on the vessel where its coats are degenerated, nor at too distant a point, on account of the danger of there being too free a collateral circulation. The ligature is tied very firmly, so as to divide the inner and middle coats of the vessel, and it is small, round & firm. The artery is exposed as little as possible, and to such an extent only as to admit the needle to be passed round it. Care must be taken not to injure the vein or nerves surrounding the vessel, or to include them in the ligature. The one end of the ligature is then cut off, and the wound is treated as to favour its healing by the first intention.

For some time previous to the operation, as well as afterwards, until the ligature comes away and the wound is healed, it is necessary that the antiphlogistic treatment be enforced; and in some cases, where the pulse is very strong, general depletion is recommended to be had recourse to before the operation, for the purpose of reducing the heart's action. For the same purpose bleeding after the operation is advised in some cases;

And

and when the vessel tied is in the neck, it is sometimes recommended as a means of diminishing the danger of the occurrence of congestion of the lungs.

After the operation the limb is so placed that the part where the vessel is situated be relaxed. The temperature of the limb generally falls a little, but it soon rises, and as the collateral circulation becomes established, it may even rise above the natural standard.

While the temperature is lower than natural, it is not considered advisable to interfere in any way, except by covering the limb with flannel, or something similar, as reaction generally comes on sooner or later, and in some cases where gangrene has followed the operation, it has been caused by the excessive reaction brought on by applying stimulating substances during the depression occasioned by the application of the ligature to the vessel, and the consequent stoppage of the circulation.

Even after the ligature has come away the patient is generally kept in perfect rest, and should avoid all mental emotions, or any circumstances, which might accelerate the circulation. In some cases the temperature of the limb may not rise above the natural standard after the operation, but this seems to be a rare occurrence, and may be attributed to the collateral circulation becoming established before the

the

the operation was performed. When the artery is too much separated from the surrounding parts at the point where the ligature is to be applied, it may be prudent to apply two ligatures, one at each end of the detached portion, a practice which was followed in the time of Aetius, and the artery may either be divided or left entire, according to circumstances.

Brasdor thought, that, when an aneurism was so situated, that a ligature could not be placed on the cardiac side of the tumour, a cure might be brought about by placing a ligature on the distal side.

Desault also recommended this operation, but it appears that neither he nor Brasdor performed it.

Deschamps was the first who employed it, for the cure of an aneurism of the femoral artery, but without success. Sir A. Cooper next tried it for the cure of an aneurism of the external iliac, where he tied the femoral, but his patient died.

After this it was laid aside for some time from its want of success, but in 1825 Wardrop performed it, and since that time it has been performed by Bush and others in carotid aneurism.

Mr Wardrop performed his operation in those cases where the Hunterian or Brasdor's operation could not be performed. He thought that if the circulation

in the case were ligatures in force, though it was not com-
pletely checked, it would suffice for favouring the
formation of a coagulum. The results of this method
of operating were unfavourable, and it is not usually
employed. It consists in placing a ligature upon one
of the two terminating branches of an artery on the
distal side of the tumour.

Professor Dubois thought that hemorrhage
might sometimes occur from the ligature making
its way too fast through the artery. Also that gan-
grene of the limb might be brought on, especially
when the aneurism was of long standing, from the
circulation being suddenly stopped by the applica-
tion of the tight ligature, so that the collateral
branches had not time to enlarge. He, therefore, pro-
posed a way of gradually stopping the circula-
tion through the vessel, and thus give the collateral
branches more time for dilatation, and so prevent
gangrene. His method was to apply a ligature be-
neath the vessel as for the Hunterian operation, and
then to put its two ends through an instrument
called a serre-noeud, with which the compression was
gradually increased. This kind of operation is
not now had recourse to.

The circumstances to be most dreaded after the operation are, gangrene, hemorrhage and suppuration of the sac.

When the gangrene is not great, and appears to be caused by pressure, or to be dependant on the feeble state of the patient, it is treated by local and constitutional measures; but when it is of any great extent, and depends upon inflammation of the part, amputation is generally recommended, and should be performed as high at least as the part of the artery where the ligature has been placed. The hemorrhage usually takes place when the ligature comes away. It generally comes on very slowly, blood oozing away from time to time, but still increasing in quantity, till at last the patient is reduced to a state of great exhaustion. Pressure and remedies which have the power of lowering the force of the circulation may be had recourse to at first; but if these are not sufficient, the artery must be cut down upon and tied nearer the heart, or amputation of the limb be performed.

Suppuration does not usually take place until the canal of the artery has been obliterated, on account of which hemorrhage is not so liable to occur, and therefore not so much to be dreaded as the size of the abscess itself. As soon as it appears certain that the abscess contains matter, it should be fully laid open so that the contents may have vent: after it is cleared out, the cavity is usually stuffed with lint, and pressure with stimulating lotions employed.

The treatment of False aneurism is conducted according to the length of time the tumour has been in existence, and its character. Should it have existed for any length of time, or if it be of considerable size, and cannot be entirely compressed, a ligature may be applied on the cardiac side of the tumour, in the same way as is done in the case of a true aneurism by the Hunterian operation.

If we see the patient before any length of time has elapsed, however, it is generally treated by making an incision through the tumour down upon the artery and applying a ligature both above and below the part which is wounded. One end of each ligature is then cut off and the others left and the subsequent treatment is conducted so as to favour adhesion.

Thomas Miller

Edinburgh, 31st March 1853.