

Fig. 1.

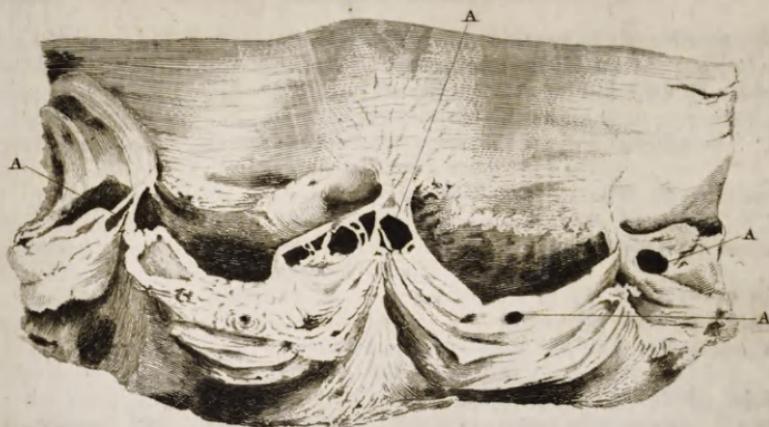


Fig. 2.

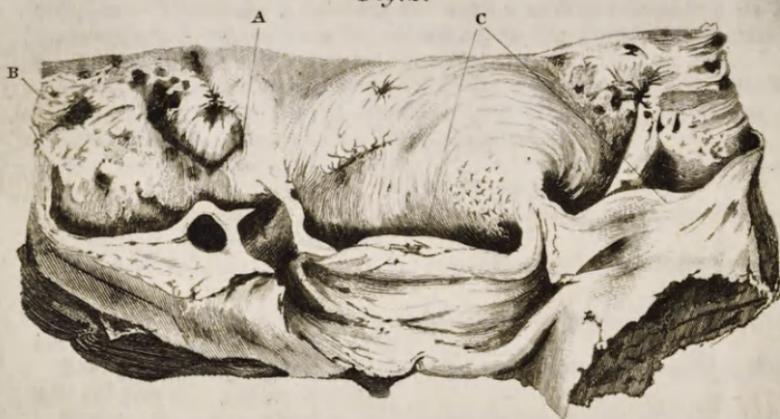


Fig. 3.



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PART I.

ORIGINAL COMMUNICATIONS.

ART. I.—*On Permanent Patency of the Mouth of the Aorta, or Inadequacy of the Aortic Valves.* By D. J. CORRIGAN, M. D. one of the Physicians to the Charitable Infirmary, Jervis Street, Dublin; Lecturer on the Theory and Practice of Medicine; Consulting Physician to St Patrick's College, Maynooth. (With Engravings.)

THE disease to which the above name is given has not, so far as I am aware, been described in any of the works on diseases of the heart. The object of the present paper is to supply that deficiency. The disease is not uncommon. It forms a considerable proportion of cases of deranged action of the heart, and it deserves attention from its peculiar signs, its progress, and its treatment. The pathological essence of the disease consists in inefficiency of the valvular apparatus at the mouth of the aorta, in consequence of which the blood sent into the aorta regurgitates into the ventricle. This regurgitation, and the signs by which it is denoted, are not necessarily connected with one particular change of structure in the valvular apparatus, and hence the name *Permanent Patency of the Mouth of the Aorta, or Inadequacy of the Aortic Valves*, has been chosen as simply expressing such a state of the parts as permits the regurgitation to occur.

I have been in the habit for some years of describing this disease under the name of *Inadequacy of the Aortic Valves*; but as Dr Elliotson, in his elegantly written work on Diseases of the Heart, has given to a somewhat analogous morbid state of the auriculo-ventricular opening, a better name, *Permanent Patency*, I have, for that reason, and for the sake of uniformity, adopted the term, and I shall continue to use it as synonymous with my own term, *Inadequacy of the Aortic Valves*.

The morbid affections of the valves and aorta permitting this regurgitation are the following.

1st, The valves may be absorbed in patches, and thus become reticulated and present holes, through which the blood flows back into the ventricle.—*Vid.* Plate I. Fig. 1.

2d, One or more of the valves may be ruptured; the ruptured valves, when pressed, flapping back into the ventricle instead of catching and supporting the column of blood in the aorta, the blood then regurgitating through the space left by the broken valves.—*Vid.* Plate I. Fig. 2.

3d, The valves may be tightened or curled in against the sides of the aorta, so that they cannot spread across its mouth; and an opening is then left between the valves, in the centre of the vessel, through which the blood flows freely back into the ventricle.—*Vid.* Plate I. Fig. 3.

4th, The valves without any proper organic lesion may be rendered inadequate to their function by dilatation of the mouth of the aorta. The aorta, affected by aneurism, or dilated, as it frequently is in elderly persons, about its arch, will sometimes have the dilatation extending to the mouth of the vessel, and in such a case, the valves become inadequate to their function, not from any disease in themselves, but from the mouth of the aorta dilating to such a diameter, as to render the valves unable to meet in its centre; the blood then, as in the other instances, regurgitates freely into the ventricle.

Fig. 1. This figure scarcely needs any explanation.

It shows the reticulated valves.

The letters A, A, A, A, point out the openings produced by absorption in the valves, through which the blood regurgitated. These valves were very slightly thickened.

Fig. 2. A, points out the left-hand valve, with an opening through it large enough to admit a goose quill, and ruptured from its connection with the aorta, so that it flapped back into the ventricle.

B. Bony depositions on the inner coat of the aorta.

C. The middle and right hand valves thickened, and contracted in their free edges, so that they could be separated only a very short distance from the sides of the aorta.

Fig. 3. A, A, Openings in the valves, as in Fig. 1, produced by absorption, one of the openings in the right hand valve large enough to permit the finger to pass through.

B. Middle valve, projecting downwards, curled back, and bound to the aorta by bony deposition, so that it was totally useless.

C. Bony deposition tying the edges of the middle and right hand valve together, and at the same time gluing them to the aorta.

General Symptoms.—On the general symptoms that accompany this disease, little is necessary to be said. Like most of those connected with affections of the respiratory and circulating organs, they are uncertain and unsatisfactory. There are frequently convulsive fits of coughing, more or less dyspnoea, sense of straitness and oppression across the chest, palpitations after exercise, sounds of rushing in the ears, and inability to lie down. Neither one nor all of these symptoms are essential to the disease. They may all arise from varied affections of the lungs, heart, liver, or nervous system. They neither tell us the seat of the disease, nor the extent of the danger.

Signs.—What is deficient in general symptoms from their obscurity, is, however, amply supplied by the certainty of the physical and stethoscopic signs, which may be referred to the three following indications. 1st, Visible pulsation of the arteries of the head and superior extremities. 2d, *Bruit de soufflet* in the ascending aorta, in the carotids, and subclavians. 3d, *Bruit de soufflet* and *fremissement*, or a peculiar rushing thrill felt by the finger, in the carotids and subclavians. In conjunction with these may be reckoned the pulse, which is invariably full. When a patient affected by the disease is stripped, the arterial trunks of the head, neck, and superior extremities immediately catch the eye by their singular pulsation. At each diastole the subclavian, carotid, temporal, brachial, and in some cases even the palmar arteries, are suddenly thrown from their bed, bounding up under the skin. The pulsations of these arteries may be observed in a healthy person through a considerable portion of their tract, and become still more marked after exercise or exertion; but in the disease now under consideration, the degree to which the vessels are thrown out is excessive. Though a moment before unmarked, they are at each pulsation thrown out on the surface in the strongest relief. From its singular and striking appearance, the name of *visible pulsation* is given to this beating of the arteries. It is accompanied with *bruit de soufflet* in the ascending aorta, carotids, and subclavians; and in the carotids and subclavians, where they can be examined by the finger, there is felt *fremissement*, or the peculiar rushing thrill, accompanying with *bruit de soufflet* each diastole of

these vessels. These three signs are so intimately connected with the pathological causes of the disease, and arise so directly from the mechanical inadequacy of the valves, that they afford unerring indications of the nature of the disease. In order to understand their value, it is necessary to consider their connection with the cause by which they are produced. The visible pulsation of the arteries of the neck, &c. may be first examined.

In the perfect state of the mechanism at the mouth of the aorta, the semilunar valves, immediately after each contraction of the ventricle, are thrown back across the mouth of the aorta by the pressure of the blood beyond them, and when adequate to their function of closing the mouth of this vessel, they retain in the aorta the blood sent in from the ventricle, thus keeping the aorta and larger vessels distended. These vessels consequently preserve nearly the same bulk during their systole and diastole. But when the semilunar valves, from any of the causes enumerated, become incapable of closing the mouth of the aorta, then after each contraction of the ventricle, a portion of the blood just sent into the aorta, greater or less, according to the degree of the inadequacy of the valves, returns back into the ventricle. Hence the ascending aorta and arteries arising from it, pouring back a portion of their contained blood, become, after each contraction of the ventricle, flaccid* or lessened in their diameter. While they are in this state, the ventricle again contracts and impels quickly into these vessels a quantity of blood, which suddenly and greatly dilates them. The *diastole* of these vessels is thus marked by so sudden and so great an increase of size as to present the visible pulsation which constitutes one of the signs of the disease.

That this visible pulsation of the arteries is owing to the mechanical cause here assigned is made evident by several circumstances. It is most distinct in the arteries of the head and neck, which empty themselves most easily into the aorta, and of course into the ventricle. In the arteries of the lower extremities, of even larger size than those which present it about the head and neck, it is not seen to any comparative degree, and most generally not at all while the patient is standing or sitting. It is much more marked in the arteries of the head and neck in the erect than in the horizontal posture; and a patient suffering under

* It may be objected to the phrase *flaccid*, that the arteries, being capable of contracting upon whatever quantity of blood they may contain, are never flaccid. In using the phrase, it is not meant that the sides of the arteries, like a collapsed vein, fall together, but merely that, having become emptied of some of their blood, in consequence of its regurgitation into the ventricle, they are, while in this state, less tense than when at the next diastole they are distended by a fresh supply of blood to their limit of extension.

the disease himself, first pointed out a circumstance which is convincing of its being produced as asserted. He could increase the pulsation of the brachial and palmar arteries in a most striking degree by merely elevating his arms to a perpendicular position above his head. He thus enabled the brachial and palmar arteries to empty themselves more easily back upon the aorta. They became more flaccid, and then, on the next contraction of the ventricle, their diastole became comparatively greater, and their visible pulsation of course more marked. The same effect could be produced in the arteries of the lower extremities by lying down and elevating the legs on an inclined plane. The strength of the heart has little to do in producing this singular pulsation, for it is never observed in an equal degree, and most generally not at all, in the arteries of the lower extremities.

If it be asked, is the explanation here adduced of the cause of this visible pulsation sufficient to account for its appearance in the brachial and radial arteries, since the blood to return back from these vessels into the arch of the aorta should flow upward when the patient holds his arms in the ordinary position, flexed or hanging by his side? the following reply may be made. [When the subclavians are pouring back their blood into the arch of the aorta and ventricle, the elasticity of the brachial arteries, acting upon the blood just urged into them, forces it back along with the retrograde current of the subclavians, no obstacle meeting it in that direction. The brachial arteries thus partially empty themselves, and become in their systole of a lessened diameter like the carotids and subclavians, but in less degree. The next jet of blood from the ventricle dilates them, and as in the subclavians, produces in them a visible pulsation: and if they be assisted in returning their blood by elevating the arms to a perpendicular position, their pulsation becomes, as has been already observed, much more strongly marked.] The arteries of the lower extremities are not similarly circumstanced. The arteries of the upper extremities are assisted in emptying themselves back towards the heart, by the retrograde current in the subclavians and ascending aorta; but on the blood contained in the arteries of the lower extremities, the tall column of blood in the descending aorta is pressing, and prevents any return; or if it be supposed that of the large mass of blood in the descending aorta, a small portion flows back into the arch, it can produce little change in the contents of the iliacs and femorals; and moreover, whether the column of blood in the aorta be lessened or not in diameter, the pressure on the contained blood of the iliacs and femorals will remain the same, and keep these vessels distended. If we, however, as already observed, alter the relation of the several arteries to the arch of the aorta, so as to fa-

cilitate the reflux of their contained blood, for instance from the radial arteries, by raising the arms to a perpendicular line above the head, from the iliacs and femorals, by placing the patient in a recumbent posture, and raising the legs upwards on an inclined plane, the visible pulsation becomes much more marked in these respective arteries.

The *bruit de soufflet*, which is heard in the ascending aorta, carotids, and subclavians, with the accompanying *frémissement* in the latter arteries, is next to be considered. The *bruit de soufflet* characterizing this disease, is heard, as already observed, in the ascending aorta, its arch, and in the carotids and subclavians. It can be followed upwards from the fourth rib along the course of the aorta, increasing in loudness as it ascends, until it is heard of great intensity at the upper part of the sternum, where the arch of the aorta most nearly approaches this bone, and then branching to the right and left, it can be traced into the carotids and subclavians of both sides; and in these trunks it assumes a harshness that it did not possess in the aorta. This *bruit de soufflet* is synchronous with the visible pulsation, with the diastole of the arteries. It is of no consequence whether the ascending aorta and its large branches be sound or be diseased; the *bruit de soufflet* is as loud in the one case as in the other. To account for the presence of this sign, and why it extends so far from the seat of the disease and along sound vessels, it is necessary to refer to a paper published in the *Lancet* of 1829, Vol. ii. p. 1. Continued observations from the date of that paper to the present, have confirmed the view then taken of the cause of that singular sound; of its being dependent purely on a physical cause, on a mechanical change in the manner of the blood's flowing.

In that paper is related an experiment, which it may be well to recapitulate here. A flexible tube, such as a piece of small intestine, or a portion of artery, is connected by one end with a tube which has a current of water of considerable force running through it. While the piece of intestine or artery is kept fully distended by the supply of water from the tube, no sound is produced by the motion of the fluid; but if the flexible tube, while the fluid is moving through it, be pressed upon in any part, so that the quantity of fluid passing through the contracted part is no longer sufficient to keep the further portion of the tube tense, then, beyond the contracted part, where the tube is less tense, or in some degree flaccid, a distinct, and, according to the velocity or force of the current, a loud *bruit de soufflet* is heard; and, at the same time, if the finger be gently laid upon the part of the tube where the *bruit de soufflet* is heard, a slight trembling of the tube is perceived, evidently arising from the

vibrations into which the current within is throwing its sides. If, in place of constricting any one part of the flexible tube, the whole tract of tube be allowed to become partially flaccid, by diminishing the supply of fluid, and the fluid be then allowed to rush along the tube by jets, at each jet the tube is suddenly distended, resembling the visible pulsation described above; and with each diastole of the tube, there is a sudden and loud *bruit de soufflet*; and, synchronous with the *bruit de soufflet*, there is *fremissement* felt by the finger.

Both the sound heard and the sensation felt by the finger in this experiment may be explained by the principles which regulate the motion of fluids. It may be remarked, that it is a property of fluid in motion, that, when discharging itself from the orifice of a tube into open space, or into a vessel of wider capacity not fully distended, its particles move in lines from the orifice, like so many *radii* tending to leave vacuums between them. When the flexible tube, artery, or intestine, therefore, is kept fully distended, the fluid moves forward as a mass, there is no tendency in its particles to separate from one another,—they all press equally,—there is no vibratory motion of the sides of the tube, and consequently no sound, and no *fremissement* or trembling. But if the tube be not kept fully distended, then the fluid propelled through it rushes along as a current; and its particles tending to leave vacuums between them, throw the sides of the tube into vibrations, which can be very distinctly felt by the finger, and which give to the ear the peculiar sound *bruit de soufflet*, and to the touch *fremissement*.

These principles may be applied to the state of the ascending aorta and its branches in the instances before us. When the aortic valves are fully adequate to their function of perfectly closing the mouth of the aorta, and thus preventing any regurgitation of blood, the aorta and its branches are kept fully distended, the blood is at each contraction of the ventricle propelled forward *en masse*, and there is no trembling, or vibratory motion of the sides of the aorta, carotids, and subclavians, and, as in the flexible tube when fully distended, no sound is emitted. But when the valves, becoming inadequate to their office, permit some of the blood contained in the ascending aorta, carotids, and subclavians, to return into the left ventricle after each contraction, then the aorta and these trunks become, like the flexible tube in the second part of the experiment, partially flaccid; and at the next contraction of the ventricle, the blood propelled into them is sent along as a rushing current, which throws the sides of these arteries into vibrations, and these vibrations give to the ear *bruit de soufflet*, and to the finger *fremissement*. These two signs may be traced to a varying distance from the mouth of

the aorta, and always along the carotids, and to the outer third of the subclavians, and sometimes in the brachial arteries, as far as the bend of the arms, the distance to which they are heard being determined by the limit to which the current-like motion of the blood producing them is extended. In those cases in which the deficiency of the valves is considerable, allowing a full stream of blood to rush back into the ventricle, there is heard in the ascending aorta a double *bruit*; the first accompanying the *diastole* of the artery, the second immediately succeeding; and, in listening to the two sounds constituting this double *bruit de soufflet*, the impression made distinctly on the ear is, that the first sound is from a rushing of blood up the aorta, the second from a rushing of it back into the ventricle. It is impossible for those who have not heard this double *bruit* to conceive the distinctness with which the impression described is made on the ear. A patient in one instance heard this double sound distinctly in his own person, and referred it to its cause, a rushing of blood *from* and *to* the heart. The *bruit de soufflet* and *fremissement* are not perceived in the arteries of the lower extremities, when the patient is in a sitting or standing posture. The pressure of the blood in the abdominal aorta is sufficient in these postures to keep the vessels arising from it fully distended; and thus no vibratory motion of their parietes being permitted, there is no bellows sound, nor *fremissement* or rushing thrill.

History and Progress of the Disease.—Of eleven cases of the disease, only two occurred in females, and in both of these the valves were nearly quite sound in texture; but the aorta being thinned and dilated, the valves could not meet so as to prevent regurgitation. None of the cases occurred in very early age. The youngest person presented labouring under the disease was twenty years of age. In this respect, inadequacy of the aortic valves differs from narrowing of the left auriculo-ventricular opening, which is not unfrequently met with in children, and even in infants at the breast. The causes of the disease are uncertain. In one case the disease followed an attack of acute rheumatism, which had been accompanied with symptoms of *pericarditis*. In some cases the commencement of the disease was referred by the patient to an inflammatory affection of the chest, which had occurred months or years before; while in others no cause or date could be assigned.

The symptoms accompanying its commencement and progress are very variable. Most generally the patient describes the first sensations as having been a feeling of oppression and straitness across the chest, with palpitation of the heart on any unusual exercise. These symptoms become gradually more distressing,

and are after a very uncertain period of time accompanied by fits of coughing resembling paroxysms of asthma, and terminating in scanty expectoration. In a few cases, however, cough was not at any time, even up to the last hours of life, an urgent symptom; the oppression and straitness of the chest, with palpitation on any exertion, and an anxiety for a supply of fresh air, being the principal complaints. As the disease proceeds, the straitness and oppression about the chest become more distressing; fits of coughing more frequent; and the patient has an anxiety, approaching to agony, for a free supply of fresh air, frequently starting from bed at night under the dread of suffocation. In the last stage the state of suffering is extreme. The patient will not lie down for a moment from the dread of suffocation. The face, which had been pale, becomes purple on the lips as in suffocative catarrh; œdema of the legs comes on, followed ultimately by œdema of the hands and arms; there is no sleep, or there are almost incessant startings from it; the countenance assumes a most painful expression of sinking; and the patient at length dies exhausted. The pulse in no case was under eighty. It ranged from that to 110; and in every case it has been all through the disease (unless influenced by medicine) full and vibrating, even to within a few hours of death. In the course of the disease, the superficial branches of the carotids, the brachial arteries, the radial, and the ulnar, and their branches, wherever near enough to the surface to be traced, become apparently enlarged, and remarkably tortuous;—the brachial artery in parts of its course often almost doubling upon itself. The *fremissement*, or rushing thrill, described as easily felt in the subclavians and carotids, can sometimes be felt by moderate tact as fast as the pulse in the wrist. The heart in all the cases that occurred was enormously enlarged, and its bulk arose from the state of the left ventricle, which in some cases was so much enlarged in cavity and in thickness, as to make the organ resemble rather the heart of a bullock than that of a man. The other parts of the heart, although necessarily obliged to keep pace in some measure with this increased size, did not at all partake equally in the enlarged bulk. The impulse of the heart was far less than natural, even in cases where the hypertrophy of the left ventricle was greatest. In some of them no impulse could be felt; and in none did the impulse during life give at all a proportional measure of the excessive hypertrophy discovered after death. *

* Laennec has stated, and his assertion is supported by many, that the degree of impulse is always a correct index of the degree of hypertrophy of the ventricle, but it is now admitted by some most capable of judging, that the impulse of the heart is

Hæmoptysis very rarely occurs in the course of the disease, and the lungs are generally found after death permeable to air, and remarkably healthy. This is owing to the sound state of the auriculo-ventricular opening, and of its valves. This opening being full sized, permits the blood to pass with freedom into the ventricle, where it is retained by the sound auriculo-ventricular valves; and thus those sudden congestions of the blood-vessels of the lungs, so common in narrowing of the left auriculo-ventricular opening, are remarkably rare. The manner of death in inadequacy of the aortic valves is different from that in narrowing of the auriculo-ventricular opening. In the latter, owing to the obstacle presented by the narrowed opening to the passage of blood into the ventricle, the lungs are by any slight exciting cause suddenly congested; and the patient dies, not from the direct effect of the organic affection of the heart, but from the superinduced affection of the lungs,—pulmonary apoplexy, pneumonia, or suffocative catarrh. In the disease under consideration, the patient appears to die of mere exhaustion. The inefficiency of the valves of the aorta throws a great increase of labour on the left ventricle. The muscular energy of this part of the heart is in the course of time worn out. The heart is at length incapable of sustaining the column of blood incessantly pressing upon it; it ceases to contract, and is found after death largely distended with blood. The symptoms preceding death are in accordance with this state. For some days, or even weeks, before death, nature appears to be struggling against overwhelming exhaustion. The patient is constantly in the most heart-rending tone imploring to be relieved of the weight that is upon him; the countenance expresses the greatest sinking and distress; there are anxious calls for fresh air, and a continual restlessness, similar to what is seen in a patient sinking from hemorrhage; and when in this state the patient in some trifling motion dies exhausted.

The duration of this disease is very uncertain. No case was

not to be considered a gauge of the hypertrophy of the ventricle. Andral, in his "Clinique Medicale," Vol. ii. p. 160, says "Plus d'une fois dans des cas où apres la mort nous avons trouvé les parois des ventricules tres epaissies en même temps que leurs cavités etaient notablement agrandies, nous n'avions reconnu pendant la vie aucune espèce d'impulsion. Dans d'autres cas, où il y avoit simple hypertrophie du ventricule gauche, avec grande diminution de sa cavite (hypertrophie concentrique de MM. Bertin et Bouillaud,) il n'y avoit pas eu non plus d'impulsion appreciable." Piorry (sur la Percussion, p. 139) says, that impulse of the heart, carried even to raise the head of the observer, is far from being a constant sign of hypertrophy. Dr Graves, in a clinical lecture, (*vid.* Med. Gazette, March 1831, p. 714,) says, "I can assert in the most positive manner, that I have seen cases of pneumonia in which the heart's pulsation continued violent until within a short time of dissolution; so much so indeed, as to induce the erroneous belief in myself and other medical attendants, that this organ was in a state of hypertrophy and dilatation, and yet it was found after death to be in every respect healthy." This subject will be resumed at another time.

of less duration than two or three years, and some of the cases at present under treatment have been of seven or eight years standing. The time during which the disease may continue without terminating fatally, seems to depend principally upon the extent to which regurgitation is permitted. The cases in which the valves, from small perforations, allowed but little regurgitation, continued for many years; while the case which furnished the Plate No. II. and in which the valves were ruptured and much injured, allowing considerable regurgitation, terminated fatally in less than three years.

Diagnosis.—Inadequacy of the aortic valves may be confounded with narrowing of the mouth of the aorta, either congenital or from diseased valves, with disease of the auriculo-ventricular valves, with aneurism of the arch of the aorta or *arteria innominata*, with nervous palpitations, and with asthma. Congenital narrowing of the mouth of the aorta is a very rare disease, but narrowing of the mouth of this vessel produced by vegetations on the valves is not unusual; and *bruit de soufflet* is a sign common to it, and to the disease we are considering. The resemblance between the signs of the two diseases extends, however, no farther. The visible pulsation of the arteries, arising from the arch of the aorta, which forms so striking a sign of inadequacy of the aortic valves, is wanting in narrowing of the mouth of the aorta. The pulse also is strikingly different in the two diseases. In narrowing of the aortic orifice it is small and contracted; in inadequacy of the aortic valves it is invariably full and swelling. In narrowing of the aortic orifice there is generally a marked contrast between the pulse and the impulse of the heart. The pulse is small and contracted; the impulse of the heart is strong and energetic. In the disease we are considering, when there is a contrast it is always in the inverse way; for while the arteries beat with violence, and the pulse is strong and full, the impulse of the heart is scarcely perceptible. When the mitral valves, becoming indurated or ossified, produce narrowing of the auriculo-ventricular opening, that narrowing produces *bruit de soufflet*; * and the *bruit de soufflet* thus produced might be confounded with that accompanying inadequacy of

* The principles regulating the motion of fluids, already laid down, explain the production of *bruit de soufflet* in narrowed auriculo-ventricular opening. The blood at each contraction of the auricle discharges itself from a narrow orifice into the ventricle, "a vessel of wider capacity not fully distended."—"The particles" of the blood "move in lines from the orifice, like so many radii tending to leave vacuum between them." This motion, as in the experiment of the tube, throws the sides of the ventricle into vibrations, which produce on the ear *bruit de soufflet*, and if the heart thus affected come forward so as to transmit through the parietes of the chest this vibrating motion, the hand laid over the heart perceives a *fremissement*, or trembling in the organ, the *bruissement* of Corvisart.

the aortic valves. Independently of the visible pulsation of the arteries, and the state of the pulse, which accompany inadequacy of the aortic valves, stethoscopic examination points out with certainty the distinction of the two diseases. When the *bruit de soufflet* is produced by narrowing of the auriculo-ventricular opening, it is heard loudest just where the impulse of the heart against the side is felt; it comes with the impulse, and if loud it seems to rush into the ear; and as the stethoscope is removed from this point upwards along the sternum, it is heard growing fainter the farther the point of examination is from the point where the impulse is felt. In inadequacy of the aortic valves, the converse holds. For over the point where the impulse is or should be felt, *bruit de soufflet* is either not heard at all, or heard very indistinctly; but as the stethoscope is moved upwards from the heart, in a line corresponding with the ascending aorta, the *bruit de soufflet* is heard growing louder and louder, until over the arch of the aorta, and in the large trunks arising from it, the sound grates upon the ear with harshness.

Permanent patency of the mouth of the aorta may be mistaken for aneurism. If the arch of the aorta and *arteria innominata* approach more nearly than usual to the notch of the sternum, the visible pulsation at the root of the neck becomes so prominent, as to lead to a supposition that there is aneurism, and even of considerable size at this part.

Very lately a case came under my observation, in which there was a remarkable resemblance to aneurism. So strong were the pulsations for years in the region of the *arteria innominata*, that until the examination after death there was never even a doubt expressed that the case was not aneurism. The aorta was thinned, and was dilated so much as to render the valves inadequate to their office, and leave a permanent patency between them. The *arteria innominata*, the carotids, and subclavians, were also dilated beyond their natural size, thus increasing the appearance of the pulsation, but there was no trace whatever of aneurism in the *arteria innominata*, such as had been supposed to exist there during life. An acquaintance with the disease under consideration, and a knowledge of the fact, that a violent throbbing at the root of the neck, or notch of the sternum, may arise from another cause than aneurism, will prevent the forming of a rash opinion on the cause of the violent throbbing. This throbbing may proceed from aneurism, or may arise from inadequacy of the aortic valves. When it proceeds from aneurism of the arch, or of the *arteria innominata*, it is confined to the vessel or the region of the vessel affected; the other trunks arising from the arch present only their natural, or even a diminished pulsation, and there is in

the trunks arising from the arch neither *bruit de soufflet* nor *fremissement*. On the contrary, when the throbbing at the notch of the *sternum*, or in the region of the *arteria innominata* is from inadequate aortic valves, all the larger trunks arising from the arch pulsate in an equal degree, or with trifling differences, arising merely from the relative sizes of the vessels, or their relation to the surface, and they are never at any time without *bruit de soufflet* and *fremissement*.

Not only in relation to treatment, but in regard to the patient's mental anxiety, it is of importance to be aware, that inadequacy of the aortic valves may, by this violent pulsation at the root of the neck, closely simulate aneurism of the arch of the aorta, or the root of the *arteria innominata*. In aneurism of the aorta life is not for a moment secure, and it may be necessary that even for a remote hope of cure the patient should totally abstain from all exertion. In permanent patency of the mouth of the aorta the fatal result is never sudden; and under proper restriction the patient is not only able to lead an active life for years, but is actually benefited by doing so.

The two diseases, aneurism of the aorta, and inadequacy of the valves, may, however, be combined. Aneurism of the ascending aorta may, by extending to the mouth of this vessel, dilate it so, that the valves are unable to meet, and there is then a combination of the two diseases; there is aneurism and there is permanent patency of the aortic opening. The first cases that came under my observation presenting the signs of inadequacy of the aortic valves were cases in which the valves were rendered useless in this way, namely, by the mouth of the aorta sharing in the aneurismal dilatation. These cases led me into an error; for, meeting the signs of permanent patency of the aortic orifice in conjunction with aneurism, I erroneously attributed to the aneurism the signs which arose from the permanent patency.* Aneurism of the aorta of itself does not produce the signs arising from permanent patency of the mouth of the aorta. It can only produce them in the way already described, by involving in the dilatation the mouth of the aorta; and hence, when in conjunction with an aneurismal tumour of the *arteria innominata* or aorta, there are found visible pulsation, *bruit de soufflet*, and *fremissement* in the ascending aorta, and the trunks arising from it, we may be certain, that, in addition to the aneurism, there is a defect in the aortic valves, or that the aneurism has extended downwards, involving the mouth of the aorta. On the other hand, if these signs be absent, the valves are sound, and the mouth of the aorta is not included in the disease. The

* *Vide Lancet* for February 7th 1829.

propriety of performing Mr Wardrop's, or indeed the common operation for aneurism about the neck, might depend on the information thus acquired of the state of the aortic valves. To perform either in a case where the aneurismal dilatation was extensive as to involve the mouth of the aorta, or where aortic valves were diseased, would only bring the surgical treatment of the disease into unmerited discredit.

Palpitation of the larger arterial trunks, depending on derangements of the nervous system, will sometimes in their violence simulate the visible pulsation arising from inadequate aortic valves; and in females these palpitations will last not only for months but for years, and seem to justify an opinion that there is organic disease of the heart. This nervous palpitation is not, however, accompanied by *bruit de soufflet* and *fremissement*; and the absence of these two signs is conclusive as to the nature of the disease. Sometimes, however, more than one examination is required before pronouncing a positive opinion; for in a nervous patient, the alarm excited by the first examination will render the circulation hurried and irregular, and hence there may be in the carotid or subclavian a momentary *bruit de soufflet*. In making the examination it is moreover necessary, that the edge of the stethoscope should not be allowed to press on the artery, because its pressure is sometimes sufficient in those cases to produce the sound. When the *bruit de soufflet* and *fremissement* are only momentary, no value should be attached to them. In permanent patency of the aorta they are never absent. The convulsive fits of coughing ending in difficult mucous expectoration have made some cases of this disease be mistaken for asthma, and the state of the pulse has served to maintain the error; for the pulse being remarkably full, as it always is in the disease we are considering, seemed to be sufficient evidence that there was in the heart no obstruction to the circulation; hence the convulsive fits of coughing were supposed to have their origin in the lungs. With a knowledge of the signs afforded by the disease, no one of even moderate acquaintance with the stethoscope can confound it with asthma; without a knowledge of the stethoscope it will, however, be impossible in very many instances to distinguish between the two diseases. General symptoms will give no information on which the slightest reliance can be placed.

Treatment.—There is no class of diseases to which the scientific principles that guide modern medicine have been less applied than to diseases of the heart. From its curious mechanism, from the varied derangements to which that mechanism is subject, from the number of tissues that enter into its formation, and from its numerous sympathies, its diseases frequently demand most opposite lines of treatment; and yet it would seem,

from the perusal of works on the subject, that one principle were thought sufficient for guiding the treatment of nearly all the diseases of this important organ. With the idea of heart disease, too frequently associated the notion that such disease, without regard to its precise nature or its cause, requires the action and continued enforcement of measures calculated to exhaust strength and depress vital energy; and this error is sanctioned by the standard works on the treatment of heart disease.

Corvisart says, that "in a great number of organic lesions of the heart, as, for example, in active aneurism, the indication is to diminish the general strength of the patient, and that of the heart in particular." Laennec, p. 739, says, that "though we cannot remove indurations of the valves and narrowing of their openings, we are nevertheless in such cases to follow up the same measures, (bleeding and starving) to remove or diminish hypertrophy:" and Bertin, p. 233, states that "the treatment of valvular alterations is to consist of general and local bleedings, of low diet, of preparations of digitalis," &c.; and p. 367, "that the measures to be employed against hypertrophy are to be essentially antiphlogistic, and calculated to produce debility." A little reflection on the nature of the disease now before us will show that these principles are inapplicable both to the treatment of the valvular alterations, and of the hypertrophy of the left ventricle, which accompanies that alteration.

The disease we are considering is an inadequacy in the valvular apparatus at the mouth of the aorta permitting a regurgitation of blood into the ventricle. In the perfect state of the valvular apparatus at the mouth of the aorta, the valves support by intervals the column of blood in the aorta, and the heart with its ordinary complement of fibre and of muscular strength, is with this assistance competent to the office it has to perform. But when, in consequence of a deficiency in the valvular apparatus, the heart does not receive its due share of assistance from these valves, and is obliged to perform not only its own function of propelling the blood, but has in addition to support after each contraction a portion of that weight of blood which should then be wholly supported by the valves, it is no longer in its ordinary state equal to the task imposed upon it. In such circumstances, nature, to enable the heart to perform the additional labour thrown on it, increases its strength by an addition of muscular fibre, and the heart thus becomes hypertrophied, in accordance with the general law, that muscular fibres become thickened and strengthened when there is additional power required from it. Is this hypertrophy disease, or is it a wise provision of nature, by which the organ is thus made equal to the increased labour it has to perform? On the answer depends the treat-

ment to be adopted ; and on this there is no room for hesitation. A heart of ordinary strength could not, under the circumstances, carry on the circulation ; and nature then wisely endows the heart with the requisite degree of strength. It is at once obvious that to interfere with this wise provision of nature, to diminish the strength of the heart, or, if we choose other words, to direct, according to the advice of Laennec, Bertin, &c. our measures against the hypertrophy of the organ, is to deprive the system of the only power which enables the heart to carry on the circulation. No one thinks of directing measures to diminish hypertrophy of the muscular tissue of the stomach, in narrowing of the pylorus from scirrhus of the bladder or rectum in stricture of the urethra or intestines.

In these instances the hypertrophy is recognized as a provision of nature to make the power of the part equal to the obstacle it has to overcome ; and yet this simple principle seems to have been entirely overlooked in diseases of the heart, as if this organ possessed muscular fibres of a different nature from other organs, or as if, in adapting itself to obstacles affecting its action, it follows laws different from other muscular parts. The consequence of the neglect of this principle has been, that too often, in treatment of a valvular alteration in the heart, there has been a constant struggle between nature and medicine. Nature has been making the organ equal to its task ; while medicine has been directed to counteract nature's efforts, and, by weakening the organ, to render it totally incapable of its task. The repeated bleedings, the starvings, the enforcement of debilitating measures, are totally unsuited to the disease we are considering.

Instead of such treatment, the measures most beneficial are those which, by strengthening the general constitution, will give a proportionate degree of vigour to the muscular power of the heart, and thus enable it to carry on the circulation in the absence of that assistance which it ought to receive. With this view, a generous and sufficient diet of animal and vegetable food should be advised, at the same time that an abstinence from those beverages, such as malt liquors, which increase much the mass of the fluids, should be enjoined. It is not at all necessary that the patient should be prohibited from attending to his business or profession, provided that he do not devote to it so much attention as to produce debility. And as there is among patients who have learned that they are afflicted with heart disease an universal dread of sudden death, it is necessary to undeceive them on this point ; and in the present instance it can be done with perfect safety, as the termination of the disease is never sudden. This plan of treatment, opposite to what has been generally enjoined, was forced upon the attention long

before the reasoning adduced here had been brought to support it.

One case may be mentioned, out of many that occurred, showing the bad effects of debilitating treatment in the disease before us, and exemplifying the evil of acting as if one principle were sufficient for guiding us in the treatment of all heart diseases. It is now several years since a consultation was held upon the case alluded to. The treatment ordered was in accordance with that generally recommended, consisting of repeated small bleedings, blistering, the exhibition of digitalis, and the most rigid regulation of diet, a total abstinence from animal food, and even a spare allowance of vegetables and milk. At the time the patient, a young man, was put under this treatment, he was not in an alarming state; but the disease being recognized as heart disease, he had the fortitude to submit to a course which he was led to expect held out a prospect of cure. Bleeding after bleeding, and blister after blister, were repeated, starvation enforced, and digitalis exhibited, until the patient was reduced to such weakness that he had scarcely strength to raise himself in bed. The local disease was all this time, however, growing worse; for the palpitation, cough, &c. were, from the slightest cause, increased to greater violence than previously to the commencement of treatment. The plan was, nevertheless, persevered in, until the patient's death being supposed at hand, this debilitating treatment was discontinued. From that hour the patient got better; and as muscular strength returned, the embarrassment of breathing, palpitation, cough, &c. became less and less urgent. The patient is still alive, the disease is still present; but, with full living and good air, he is able not only to take considerable exercise, but even to undergo the fatigue of a business that constantly requires very laborious exertion.

Having laid down the plan of treatment proper to be adopted as far as it produces effects upon the system, and through it upon the heart constituting a part of the system, it now remains to examine the propriety of employing in this disease a remedy such as *digitalis*, which produces a specific effect upon the heart rendering its action slow and weak, and which in consequence of that effect is usually recommended in cases of heart disease in conjunction with the measures already deprecated. In inadequacy of the aortic valves the pulse generally ranges from 90 to 110. After each contraction of the ventricle during the pause or interval of rest occurring between that contraction and the next following, a quantity of blood is regurgitating into the ventricle. The danger of the disease is in proportion to the quantity of blood that regurgitates, and the quantity that regurgitates will be large in proportion to the degree of inadequacy of the valves, and to the length of pause between the

contractions of the ventricle during which the blood can be pouring back. If the action of the heart be rendered very slow, the pause after each contraction will be long, and consequently the regurgitation of blood must be considerable. Frequent action of the heart, on the contrary, makes the pause after each contraction short; and in proportion as the pauses are shortened, the regurgitation must be lessened. Instead, then, of regarding an increase of frequency in the action of the heart as an aggravation of the disease, it must be viewed, as we have already viewed hypertrophy of the heart, as a provision for remedying as far as possible the evil consequences arising from inadequate valves. To retard in such circumstances the action of the heart would be to do an injury. In every case of this disease in which *digitalis* has been administered, it has invariably aggravated the patient's sufferings. The oppression has become greater; the action of the heart more laboured; the pulse intermittent, and very often dicrotic, from the heart's being unable by a single contraction to empty itself; general congestion and dropsy, if present, have been increased, and in some of the instances *bronchitis* from congestion has been induced; the respiration became laborious, and the strength so much sunk, that patients seemed almost moribund. From this state they only recovered by omitting the *digitalis*, and putting them on stimulants. In no case of this disease did *digitalis* produce the slightest good effect; and in all, the patients while under its exhibition were always worse.

A moderately quick pulse indeed is of itself no evil;—it is only an evil as an indication of some disease. In the present instance it is, however, an index of a positive good; it shows that the pauses between the contractions of the ventricle are short, and, consequently, that there is less danger of the quantity of blood thrown back upon the ventricle in the pause of its action, or intervals of rest, being of any considerable amount. The pulse, which in this disease ranges from 90 to 100, or even rises higher, is not to be interfered with merely because it is more frequent than natural. The more frequent action of the ventricle indicated by that pulse is a safeguard against regurgitation. In this respect permanent patency of the aortic opening differs from narrowing of the auriculo-ventricular opening. In permanent patency, as already explained, frequent contractions and short pauses are the best safeguard against regurgitation. In narrowing of the auriculo-ventricular opening, on the contrary, slow action of the heart is an object of the first importance; for a slow action of the auricle will allow more time for the passage of the blood through the narrowed opening, and thus diminish the regurgitation upon the pulmonary veins and the lungs.

Although depleting measures and a lowering plan of treatment have been deprecated in the management of inadequacy of the aortic valves, and although the continued employment of such measures in cases of this disease, instead of bringing relief, never fails to produce an aggravation of symptoms, there are, however, circumstances in which the most active treatment is called for. Inflammatory affections, congestions, &c. are more likely to occur in patients suffering from any obstacle to the circulation than in others, and whenever these supervene in patients labouring under inadequacy of the aortic valves, whether they be inflammatory affections or congestions of the thoracic or abdominal viscera, they call for the most prompt and active treatment. Instead of the heart affection inducing us to be less active in our treatment, it is a motive to be more prompt than in ordinary cases. It may be a fatal mistake to suppose that the presence of the heart disease is to make our measures less energetic. Pneumonia, peritonitis, acute rheumatism, have occurred in some of the cases that have been under observation, and the patients have borne depletion even better than persons without any heart affection. It is a curious fact, that bleeding carried to a very large amount has never in these cases produced fainting. In this case the well-established principle, that in acute diseases the more prompt and decided the measures, the more rapid will be the recovery of the patient, and the less troublesome the sequelæ of the disease, should be our guide. The inflammatory affections that may incidentally occur in cases of inadequacy of the aortic valves, should be opposed with promptitude and decision; bleeding, when used, should be large; but when the inflammatory affection is once subdued, we should cease as soon as possible from debilitating treatment,—which, if persevered in, will prove injurious to the organic affection. No details need be given of the measures to be adopted in those incidental affections, because they differ in no respect, except in energy, from the usual treatment for the affection, whatever it may be, that has chanced to supervene. This active treatment on the occurrence of local inflammation is not at all incompatible with the course recommended to be followed when there is no disease present but the valvular inadequacy. Those incidental inflammatory or congestive affections will be rendered less likely to occur by the previous course of management recommended; for the greater vigour the system has enjoyed, the less danger there is of slight causes producing inflammation or congestion.

Lastly, There is besides the supervention of local inflammation or congestion, yet another circumstance, in which blood-letting may be required. Without the occurrence of any apparently adequate cause, straitness of chest, difficulty of breathing, tu-

multuous action of the heart, and a general feeling of nervous oppression are complained of. Neither pneumonia nor inflammatory action in any organ can be detected, and these symptoms seem to arise from an increase of bulk in the absolute mass of blood circulating, which keeps all the vessels so distended that the heart becomes oppressed, incapable of freely contracting, and tumultuous in its action. Relief is at once afforded by a large blood-letting, speedily followed by the exhibition of a full dose of an opiate. For the employment of the opiate, I am indebted to the suggestion of my colleague Dr Hunt, and its good effects are such as to have no substitute for it. The employment of a large bleeding in either of the circumstances here detailed, is very different from the repetition of those irritating small bleedings that are usually practised.

Fits of coughing are sometimes very troublesome in the course of the disease, and where they arise from trifling bronchitis, they are best relieved by pectoral mixtures with a large proportion of opium, not less than four or five grains to an eight ounce mixture.

In these observations no medicine or treatment has been recommended with the view of acting directly on the aorta or valves, so as to restore in any degree the function of the latter. There is no medicine that can have any such power after the disease has been of much standing; and if the valves have become perforated or broken, it is obviously impossible to restore them to their original state. The disease is seldom seen in the commencement. Perhaps if seen early in those cases where it has followed an attack of rheumatism, or where it partakes of an inflammatory character, the employment of mercury pushed to salivation, and counter-irritation, might check the progress of the disease. In the advanced stages no good effect on the valvular affection has been produced by any or all of these measures.

Although the cure of *Inadequacy* of the Aortic Valves is probably out of the reach of medicine, a correct knowledge of the nature of the affection is not the less necessary. The patient is relieved from harassing treatment, that, however applicable in other cases of heart disease, is not alone useless, but positively injurious in this. In other affections of the heart there is a constant danger of sudden death from pulmonary apoplexy or hemorrhage, which may be induced even by ordinary exertion, and such danger keeps the patients in a state of perpetual terror. In this disease, on the contrary, assurance may be given against any sudden termination; and the patient may be permitted not only to attend to his business or profession, but may be assured, that, in leading a life of business and tolerable activity, he is adopting the very best means to prolong his life. Under treat-

ment such as recommended, it is astonishing what little uneasiness inadequacy of the aortic valves will produce,—indeed, very often not so much as those organic affections or growth of the liver, which are nevertheless viewed by the profession and by patients with much less terror.

13, *Bachelor's Walk, Dublin.*

ART. II.—*Surgical Cases.* By JOHN CAMPBELL, M. D.
F. R. S. E., Surgeon to the Royal Infirmary, Edinburgh.
(*With Engravings.*)

CASE I.—*Case of Spreading Gangrene of the Lower Extremity, in which amputation of the Thigh was successfully performed.*—John Burns, æt. 28, admitted into the Royal Infirmary, December 31st 1830. The right leg and foot are much swelled; the leg is of a natural colour, but the foot is of a bluish tinge, and pits somewhat on pressure. A little above the ankle there is a pretty deep impression or indentation, extending round the limb, as if a cord had encircled it very tightly. Over the inner aspect of the limb, in this situation, the cuticle has been torn off, and the cutis feels hard and dry, and is of a brown colour. No crepitus can be felt on examining the limb carefully. He states that the injury was caused at two o'clock A. M., by the limb having become entangled in a rope passing between the shore and a ship under weigh in Leith harbour. He is uncertain how long the rope was tightly applied round the limb, but thinks it must have been for the space of at least six or seven minutes. Skin hot and dry; pulse 90, and full.

Applicentur hirudines viginti, et postea foveantur partes læsæ Decocto Papaveris. ℞ Tartrat. Antimonii gr. ii.; Sulphat. Magnes. ꝑiiss.; Aq. Fontan. lb. i. Solve. Sumat uncias tres omni hora donec alvus respondeat.

Jan. 1st 1831.—Bowels freely moved by the medicine; some nausea and occasional vomiting; foot cold, and sensibility much diminished below the part where the rope was applied; above this, it is of a natural temperature.

Contr. fofus, et applicetur Spt. vin Camphorat. dilut.

Jan. 2d.—Foot rather more swelled, and still cold; sensibility continues much diminished; cutis on the anterior surface of the constricted part is hard and dry; glands of groin enlarged, and tender to the touch. Says that he has occasionally severe pain in the foot.

Applicetur cataplasma emolliens.