A LECTURE

ON

THE ACTION OF BLOOD-LETTING, HEAT, COLD,
AND IRRITANTS, IN THE TREATMENT
OF DISEASE.

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I PURPOSE, upon the present occasion, to direct attention to certain general principles, which may serve as guides for the employment of remedies which act by altering the amount and the distribution of blood in the vessels—I mean blood-letting, general and local; hot and cold applications; and counterirritants.

And, first, I will speak of *venesection*. This powerful remedy, which in past times has been much employed, and in many cases, apparently, with excellent results, has, during the last thirty years, fallen into disrepute. It is not now my intention to discuss the question whether this disuse of a once popular, and always a powerful, method of cure, has been the result of a change of type in inflammatory disease. This question has been very ably argued, and answered in the negative, by Dr. Hughes Bennett (*The Principles and Practice of Medicine*), and by Dr. Markham (*Bleeding and Change of Type in Disease*). Sir Thomas Watson, who, in the last edition of his *Lectures*, had expressed his opinion "that there are waves of time through which the sthenic and the asthenic characters of disease prevail in succession, and that we are now living amid one of its adynamic phases", has, with characteristic candour, in a published letter addressed to Dr. Markham, expressed his suspicion that, in the sentence above quoted, he ought to have spoken of successive waves of *opinion* rather than of *time*.

It appears, then, that, while medical opinions and medical practice have fluctuated, the diseased state which we call inflammation, and the constitutions of our patients, have remained essentially unchanged. Great errors have been committed in past times by excess in bleeding, and now the tendency is to the opposite extreme—to neglect venesection entirely, even in cases which admit of unquestionable relief from this practice. We are now suffering from an epidemic of *hamatophobia*. A fashionable and very eminent physician said to me lately, "It is so long since I have prescribed leeches, that I have forgotten the Latin name for a leech."

This irrational rushing from one extreme to another under the influence of a fashionable impulse, this drifting upon the waves of opinion without rudder or compass, is equally discreditable to us as a scientific profession and disadvantageous to our clients. It is well worth an effort to avoid this scandal for the future.

It may be laid down as a general principle that the object of blood-letting, whether general or local, is to abstract blood, either directly or indirectly, from vessels which are overfull, and to promote its more equal diffusion through the system. And, more particularly, the main object of venesection is, to lessen over-distension of the venous system, under which term I include all the vessels that contain black blood, the systemic veins, the right cavities of the heart, and the pulmonary artery. It will be found, on a careful inquiry, that all those cases in which the most striking relief has been afforded by venesection, are characterised by an impeded circulation through the lungs, and a consequent distension of the venous system. This proposition has been advocated and illustrated with much ability by Dr. Markham, in the treatise already referred to.

I will relate, in a few words, a typical case. At the end of September 1866, during my visit to the hospital, one of the sisters came to tell me that a woman who had just been admitted into Twining Ward was dying. The patient had chronic renal disease, considerable anasarca, with the physical signs of engorgement of the lungs and of liquid in the left pleura. She was gasping for breath in great agony; the face was blue; the eye-balls prominent and watery; the jugulars much distended. She was apparently dying from over-distension of the right side of the heart. I asked Dr. Fenn, the house-physician, to open the jugular vein. About ten ounces of blood escaped. As the blood flowed, the distension of the veins was seen to subside; the breathing became easier before the blood had ceased to flow; in ten minutes, the dyspnoea had passed away, and it did not return. She died three weeks afterwards, gradually worn out by the results of advanced renal degeneration.

Dr. John Reid proved, by experiments on dogs which were killed by various methods, but all involving apnoea and a consequent blood-stasis

in the lungs, that opening the jugular vein, by lessening the distension of the right side of the heart, has the effect of increasing its contractile power, and so assisting the circulation.

We shall find that this principle is applicable to nearly all those cases in which pure empiricism has led to the practice of venesection, with apparently the most satisfactory results. These cases include some forms of inflammatory disease, and others of a non-inflammatory nature. They comprise cases of pneumonia, pleurisy, and bronchitis, in which the respiratory capacity of the lung has been suddenly and greatly reduced below the requirements of the blood to be aerated, and where, consequently, there is a continual tendency to a serous effusion into the bronchi of the healthy lung-tissue, cases of apnoea, the secondary result of brain-disorder—in other words, some cases of apoplectic and of epileptic coma, in which the true object of venesection is not to arrest cerebral hæmorrhage or to lessen cerebral congestion, but to relieve the oppressed right heart, and so to help on the circulation, first through the lungs, and then through the systemic arteries.

And here it is important to observe, that a full and a strong pulse, which, in past times, has been looked upon as an indication for the practice of venesection, is rarely present in those cases in which the practice is known to have been most successful. Obviously, the true indication for venesection is not fullness of the arteries, but overfulness of the veins; and, inasmuch as this overfulness of the veins is a result of an impeded transit of blood from the venous into the arterial system, it is manifest that the arterial pulse will be the smallest and the feeblest in some of those cases in which venesection is most needed to relieve the over-distension of the venous system; while the effect of venesection will be to increase the volume and the power of the arterial pulse. In no class of cases has this been more strikingly shown than in some well authenticated cases of cholera collapse, in which venesection has been attended with the happiest results. In illustration of this, I may quote the following striking case, which has been recorded by Sir Randal Martin. (*The Influence of Tropical Climates on European Constitutions*, 6th ed., p. 349.)

"On visiting my hospital in the morning, the European farrier-major was reported to be dying of cholera. His appearance was surprisingly altered; his respiration was oppressed; the countenance sunk and livid; the circulation flagging in the extremities. I opened a vein in each arm, but it was long ere I could obtain anything but trickling of dark treacly matter. At length, the blood flowed, and by degrees its darkness was exchanged for more of the hue of nature. The farrier was not of robust health; but I bled him largely, when he who, but a moment before, I thought a dying man, stood up and exclaimed, 'Sir, you have made a new man of me.' He is still alive and well."

The reports of the Indian practitioners abound in cases like this, showing, as the immediate results of venesection, a relief from dyspnoea and cardiac distress, and an increase in the volume and force of the arterial pulse, while the blood, which had nearly stagnated in the veins, and had consequently become dark and viscid, quickly assumed its natural colour and consistency, when the disengagement of the oppressed right heart had increased the freedom of the circulation.

Bell makes the following statement (*Treatise on Cholera Asphyxia*, p. 118). "The effect of blood-letting would, indeed, sometimes appear almost miraculous. A patient will be brought in a cot, unable to move a limb, and, but that he can speak and breathe, having the character, both to touch and sight, of a corpse; yet will he, by free venesection alone, be rendered, in the course of half an hour, able to walk home with his friends."

Rogers gives the following description of the effects of venesection by a medical man who was himself the patient. "There was a sensation which I am at a loss to describe, as if my heart was ceasing to beat, and a dread of suffocation; this sensation was instantly relieved by bleeding, and I recovered immediately." (*Reports on Asiatic Cholera in Regiments of the Madras Army*, by Samuel Rogers, p. 259.)

Here I would say emphatically, that I look upon venesection, not as a cure for pneumonia, or pleurisy, or bronchitis, or for apoplectic or epileptic coma, or for any of the various forms of apnoea, or for the collapse of cholera; but only as a means of mitigating one of the accidents of those various morbid states; namely, a paralysing over-distension of the right heart and the whole systemic venous system. If we can satisfy ourselves that this state of the venous system exists to a degree that perilously interferes with the onward flow of blood, then we need not be deterred from having recourse to venesection by the general feebleness of the patient or by the special weakness of the arterial pulse. The object of venesection in all these cases is, by abstracting a certain quantity of nearly stagnant venous blood, to promote a more rapid and a more abundant supply of arterial blood to the tissues; and, amongst other tissues, to the muscular walls of the heart itself. For it should be borne in mind, that an impeded circulation through the lungs necessarily

involves a defective blood-supply to the coronary arteries, and a consequent loss of muscular power in the heart's walls, quite apart from the paralyzing over-distension of the right cavities.

When an obstruction in the larynx threatens fatal apnoea, in considering the question of tracheotomy, we take little note of what may have been the patient's previous condition of health and strength. The main question for consideration is, whether an opening in the trachea will remove the state of apnoea and the consequent asphyxia; and we act accordingly. So, with regard to venesection, while moving blood is the life of the body as a whole, and of each particular part, stagnant blood is death, whether general or local. If, then, by the withdrawal of blood from overgorged vessels, we can promote the movement of that which remains in the system, we effect a renewal of life, and we afford a physical illustration of the great doctrine that life may be lost by saving it, and saved by losing it.

These being, as I conceive, the true principles which should guide us in the practice of venesection, we see plainly the mischievous absurdity of the practice, which prevailed not long since, of bleeding a patient before a surgical operation, in order to prevent subsequent inflammation, and of bleeding persons in health periodically at certain seasons, to obviate a possible tendency to disease.

Local Bleeding.—I have long been convinced, by observation and experience, that local bleeding, by leeches or by cupping, is of great use in cases of painful acute pleurisy, pericarditis, and peritonitis, in some acute inflammatory cases of Bright's disease, and in some inflammations of the eye and of the brain. The relief from pain and distress, especially in the early stages of acute inflammation of the serous membranes, is so manifest that it can scarcely be disputed, even by the most sceptical. The relief thus afforded has received different explanations. Some practitioners maintain, that leeching and cupping are only forms of counterirritation, and that the abstraction of blood is unnecessary and useless, if not actually injurious. Others affirm that local bleeding is useful only where there is a *capillary connection* between the skin and the tissues which are inflamed. But this explanation is obviously not applicable to some of the cases in which local bleeding is most indisputably useful; for instance, to inflammation of the eyeball, of the pericardium, and of the kidney. What, then, is the *modus operandi* of local bleeding in these cases? It appears to me to admit of a most satisfactory explanation through the *arterial connection* between the skin and the parts beneath. Take, for instance, the case of pericarditis. The internal mammary artery supplies the pericardium and the integuments over the heart. By the application of leeches over the heart, we abstract blood from the integumentary branches of the internal mammary artery, and in the same proportion we divert blood from the deeper pericardial branches. So, when leeches are applied near an inflamed eye, blood is drawn from the superficial branches of the ophthalmic artery, and diverted from the deeper ocular branches.

Let me illustrate this principle by some very simple and obvious analogies. When my opposite neighbour, Mr. Poole, exhibits his well known illumination, he so depletes the main gas artery of the street, that the chandelier in my dining-room burns with a faint and feeble light. Mr. Poole obviously takes no gas directly from my pipes—there is no immediate “capillary communication” between my pipes and his—yet, by his rapid consumption, he diverts the gas from my burners. My chandelier, therefore, is the analogue of the inflamed pericardium when leeches are drawing blood through the skin. This is literally a case of inflammation being mitigated by local depletion.

I was giving this illustration to an intelligent non-medical friend, and he said: “I can give you another instance. I have a long pipe from a cistern for watering my garden; at the end of the pipe there is a tap for watering the ferns; nearer the cistern, there is another tap for supplying the general surface of the garden. Sometimes, when I am watering the ferns, I find a sudden diminution of the stream, and I know that my sister has turned on the upper tap for watering the garden.” Here, again, the ferns are in the position of the inflamed pericardium.

I am indebted to another friend for the following illustration. A spring on a neighbouring height supplies a house with water, and on its way there a branch pipe goes off to a fountain in the garden. When water is being drawn off through a large tap in the kitchen, the fountain-jet is much reduced in height. Here, again, the fountain represents the inflamed pericardium.

The same explanation applies to all the cases in which experience has shown that local bleeding is beneficial. It has been denied that cupping or leeching the loins can help an inflamed kidney more “than if the blood had been taken from the arm or from the nape of the neck.” But this surely is a mistake. The lumbar arteries, which supply the integuments of the loins, arise from the abdominal aorta close by the renal arteries; and, when leeches or cupping-glasses draw blood through the skin of the back, it is certain that the diminished pressure within

the lumbar arteries will divert a certain quantity of blood from the neighbouring renal arteries. The principle holds here precisely as in the case of the mammary artery and the pericardium. The blood will as surely take the course indicated by diminished pressure within the vessels, as the water in a pump will follow the rising piston, and the diminution of pressure in a main artery will be greatest near the point where the blood is being rapidly withdrawn through one of the branches. It may be thought that the quantity of blood thus diverted is very small; and so, in the case of venesection in the arm or neck, how slender is the stream of blood which escapes from the opening in the vein compared with the torrents which are rushing through the great venæ cavae into the right side of the heart; and yet how decidedly and promptly does this diverted current lessen the distension of the whole venous system. The effect is to remove that proverbial last straw which is threatening to break the camel's back.

If the explanation which I have given of the influence of venesection and of local bleeding be the true one, then it will be seen that, although venesection would, by lessening the amount of blood in the body, and by enfeebling the heart's action, tend to diminish the flow of blood to an inflamed pleura, or pericardium, or kidney, yet any relief thus obtained would be purchased by a much greater expenditure of blood than when the blood is drawn from vessels near the seat of inflammation.

Hot fomentations and poultices, and coverings of cotton-wool and oil-silk, have a soothing and beneficial influence in many cases of inflamed serous membranes, pericarditis, pleurisy, peritonitis. What is the operation of these remedies? Their action is very similar to that of local bleeding. The warmth relaxes the subcutaneous arteries. The skin, therefore, receives a larger supply of blood; and in the same degree blood is diverted from the vessels of the inflamed serous membrane. Then, too, there is a sort of depletion from the full cutaneous capillaries by the free local sweating which the warmth occasions.

The most marvellous illustration of the relaxing effect of warmth upon the arteries is afforded by the results of a hot injection into the veins of a patient in cholera collapse. The hot liquid (usually at 110° Fahr.), passing into the pulmonary artery, is directly applied to the inner surface of the contracted vessels, whose spasm being thus relaxed, the blood passes freely on, and the state of collapse is for the time removed. The injection is a form of hot fomentation, but with this important difference, that the fomentation is applied directly to the inner surface of each small artery, and not through the integuments to their outer surface.

The faintness which is not unfrequently induced by a hot bath is a result of the relaxing effect of the warmth upon the subcutaneous vessels. There is, consequently, a copious afflux of blood to the skin, and a correspondingly diminished supply to the deeper parts, including the brain. Now, it is remarkable that the pulse of a patient in cholera collapse is often rendered fuller and stronger by a hot bath. The venous blood returning to the heart has its temperature raised; and, in proportion to this elevation of temperature, it will tend to relax the arterial contraction in the lungs, and thus give freedom to the whole circulation. The action of the warmed blood will be similar to that of the hot injection into the veins, but less powerful in proportion as the temperature is less elevated. When bleeding was a common practice in India, it was not unfrequently found that while, during extreme collapse, the circulation was so much obstructed that no blood flowed from a cut vein, immersion in a hot bath so helped on the circulation, that the blood soon flowed from the vein with comparative freedom, and with speedy relief to the patient. It is very noteworthy, that the simultaneous application of two methods of treatment, the hot bath and venesection, both of which singly, and still more when combined, tend in ordinary circumstances to cause faintness, should give increased volume and force to the arterial pulse of a patient in cholera collapse. A convincing proof is thereby afforded of the essential difference between the collapse of cholera and the collapse of ordinary exhaustion, whether the result of cardiac weakness or loss of blood-constituents. The influence of the warmed blood in promoting the circulation is the exact counterpart of an observation of Harvey's, to the effect that, when the fillet is removed from the arm after venesection, the blood, which had stagnated in the veins and become chilled, as it returns to the heart carries with it a sensation of cold; and “fainting frequently supervenes even in robust subjects.” (*On the Motion of the Heart and Blood*, Sydenham Society Translation, p. 58.) Harvey also noticed similar results from putting a bandage on the arm, so as to make the veins swell; immersing the arm in very cold water or snow; then suddenly removing the bandage, and allowing the chilled blood to flow back to the heart. (*Ibid.*, p. 138.) We now know that the temporary check to the circulation after such an experiment is due to contraction of the minute pulmonary arteries excited by the chilled blood.

And now to return to the action and uses of hot fomentations. We

find that, in some cases of severe throbbing headache, no remedy affords so much relief as the continuous application of a sponge wrung out of hot water to the forehead and temple while the head is kept somewhat raised. The warmth relaxes the superficial arteries: there is, consequently, a partial diversion of blood from the internal carotids through the external carotids to their branches beneath the skin. In some cases, headache is relieved by immersing the hands or the feet in warm water. The arteries are relaxed, and blood is thus diverted from the head. On the other hand, the effect of putting the feet and legs in cold water is to cause "a determination of blood to the head"; and we find that the headache of anæmia and exhaustion is best relieved by keeping the head low while cold is applied to the forehead and temples. Thus, the superficial vessels being contracted by the cold, more blood is diverted through the intracranial arteries to the anæmic brain.

Dry cupping acts in a somewhat similar way to hot fomentations. It draws an abundance of blood through the arteries into the subcutaneous capillaries, which, when the cups are removed, returns through the veins to the heart. In order that dry cupping may be most effectual, each cup should be removed as soon as the vessels beneath are well filled, and then it should be reapplied. The object is first to draw the blood through the arteries into the capillaries; then to allow it quickly to return by the veins; and not to keep it stagnating in the capillaries, which will happen if the glass be retained long on one spot. Another point is not to draw the blood into the skin with sufficient force to cause extravasation, the effect of which will be to impede the circulation through the skin, and so to divert more blood into the inflamed tissues beneath. The sole object of dry cupping, be it remembered, is not to irritate the skin, but to draw blood rapidly from the arteries, and as rapidly to transmit it through the capillaries to the veins, in its backward course to the heart.

Cold applications are employed not merely to subdue inflammation of the skin, where they act by contracting the vessels, and so lessening the afflux of blood to the inflamed tissues; but I am told that it is now a common practice in Germany to apply ice to the chest in cases of pericarditis. What is to be said of this practice? In my judgment, the practice is attended with much risk. The continuous application of cold to the surface of course causes contraction of the subcutaneous arteries. The secondary results of this may be diverse in different cases. Through the nervous system there may be a sympathetic contraction of distant arteries. The arteries of the left hand may be thus excited to contract while the right hand is immersed in iced water. Thus pulmonary hæmorrhage may sometimes be arrested through the sympathetic contraction of the minute arteries of the lung, excited by the application of cold to the surface of the chest; and a vulgar remedy for epistaxis is a cold iron key applied to the skin of the back. On the other hand, the contraction of the superficial vessels under the influence of cold may drive more blood into deeper and distant parts. Thus, when the inmate of a Turkish bath is rendered faint in consequence of the large afflux of blood to the overheated skin, and a correspondingly deficient supply to the brain, a cold douche contracts the cutaneous vessels; then instantly the brain gets a larger supply of blood, and the feeling of faintness is removed. A temporary removal to the cooling-room has the same restorative influence; the cutaneous vessels contract, and more blood is diverted to the brain. So the six lights of a gas chandelier may have been burning steadily, without noise or smoke; but if now three burners are suddenly turned off, the other three, receiving an increased pressure of gas, will often begin to whistle and smoke. The same hydraulic and pneumatic principles are applicable to all these phenomena; and a consideration of these facts suggests that the application of cold to the surface, in cases of inflammation of the deeper tissues, is a remedy of doubtful and possibly of dangerous tendency.

Counterirritants.—In my judgment, a very common mistake is that of applying strong counterirritants, so as to inflame the skin, in the early stage of acute inflammation of the viscera or their investing membranes. The result is, that another inflammation, with its attendant pain and febrile excitement, is added to the primary disease. The discomfort resulting from this may be so great that the patient will think less of his original malady, which may, nevertheless, have been aggravated by the cutaneous inflammation. It should be borne in mind, that the circulation through the vessels of an inflamed part is more or less impeded, more or less stagnant. If, then, in a case of acute pleurisy or pericarditis, we excite inflammation in the skin over the chest, the result is the opposite to that which is brought about by local bleeding, by dry cupping, and by hot fomentations; for, whereas by these means we divert blood from the deeper tissues to the surface, the effect of an inflamed patch of skin is, through the arterial connexions, to throw back the blood upon the parts beneath. In applying irritants to the skin in the early stage of acute internal inflammation, care should be taken not to allow the effect to pass beyond the stage of active engorgement of the

vessels; it should stop short of capillary stasis and inflammation. I have already said that local bleeding has been supposed to operate only as a form of counterirritation. It would be nearer the truth to affirm that the so-called counterirritants act after the manner of local bleeding, by diverting blood from the inflamed parts beneath. Vesication by means of cantharides may sometimes be useful, by the depletory serous effusion from the vessels.

Let me now gather up into a few sentences the general principles which I have endeavoured to establish.

The object of blood-letting is to lessen hyperæmia of certain parts of the vascular system.

Venesection is adapted for lessening engorgement of the venous system, which is usually a result of an impeded circulation through the lungs and left heart. When there are manifest signs of engorgement of the veins and obstruction in the lungs, a feeble arterial pulse does not contraindicate venesection; and there is no inconsistency in combining the practice of venesection with the administration of stimulants.

Local bleeding, by leeches or by cupping, is useful in many cases of inflammation. The bleeding acts by diverting blood through the superficial arteries from the deeper arteries which supply the inflamed parts.

Warm baths, fomentations, poultices, and dry cupping, act in an analogous way to local bleeding, but without actually removing the blood from the system.

Cold contracts the vessels to which it is immediately applied. The result of this may be a sympathetic contraction of distant and deeper vessels, or a driving in of blood to deeper parts. Cold to the surface, therefore, is an uncertain remedy in cases of internal inflammation.

The application of strong irritants, so as to inflame the skin, in the early stage of acute internal inflammations, is a distressing and often a mischievous practice.

As a general rule, in cases of inflammation, those local remedies are the most efficacious which are the most painless, and which quicken in the greatest degree the cutaneous circulation.

TREATMENT OF FRACTURED CLAVICLE BY A CROSS-SHAPED SPLINT.

By G. GREWCOCK, Esq., Nottingham.

FRACTURED clavicle, when the fracture is oblique and there is much displacement, occasions much trouble to keep the fragments in proper apposition. When the ordinary figure-of-8 bandage is applied loosely, it is of no use; and when it is put on with the tightness necessary to replace the fragments, it very frequently excoriates the skin, and, by slipping forwards, which is often the case, the bandage presses on the dorsal end of the fractured bone, and, by pressing this downwards, exactly opposes the indications for which it has been adopted. In fact, so dissatisfied have some surgeons become with the figure-of-8 bandage, that it has been in many cases discarded; and one of the most important indications of the accident—namely, to keep the shoulder well back—has been omitted. A plan has lately come into use of keeping the patient in bed two or three weeks, a method which is extremely distasteful to the patient, and is equally unsurgical and unreasonable.

Now, in briefly considering the nature of the accident, the deformities attending it, and the obstacles to be overcome to keep the bones in proper contact for union, are the following. 1. The outer fragment, by the weight of the arm, is carried downwards. 2. By the strong muscles passing from the cheek to the arm and shoulder, the outer fragment is carried directly forwards and inwards. We have thus three indications to fulfil: by raising the arm, the displacement of the outer fragment downwards is prevented; by the pad in the axilla, it is brought outwards; and by bringing back the shoulder, the opposition of the pectoral muscles is counteracted.

The plan of treating this accident which I wish to bring under notice is not entirely new, as I find, from some old books on Fractures, that a modification of it, by the upper straight splint, was used two hundred years ago. A simple cross-shaped splint fulfils perfectly all the three indications of the accident, without the disadvantages of the figure-of-8 bandage. The manner in which it is applied is extremely simple. The shoulders, having been well brought back, are fastened to the extremities of the splint by means of a bandage passing under the axilla and over the shoulder, thus effectually overcoming the resistance of the thoracic muscles. A small pad is placed in the axilla, and the bandage, passed over the arm and fastened behind to the splint, keeps the pad in its place.

I have treated several cases by this method, and found it give greater ease to the patient than the figure-of-8 bandage, and fulfil perfectly all the indications necessary for the successful treatment of the accident.