

LECTURE VII.

ON MORTIFICATION. (Continued.)

HOSPITAL GANGRENE—ACTUAL CAUTERY—MORTIFICATION FROM ANIMAL POISONS; FROM COLD; FROM SUDDEN LOSS OF BLOOD; FROM INFLAMMATION OF ARTERIES.

I THINK it worth while to point out another case in addition to those alluded to in the last lecture, in which the destruction of parts by caustic may be resorted to with great advantage. I refer to phagedenic and sloughing sores, whether they be those that occur upon the organs of generation in persons who have been exposed to syphilitic affection, or whether they be those that appear on other parts of the body, to which the term *hospital gangrene* is usually applied. The destruction of the parts by a powerful escharotic frequently seems to destroy the poison on which the phagedena and sloughing depends. The best caustic for this purpose is the concentrated nitric acid, applied so as to make a slough of the diseased surface, and extending to the parts just beyond it. The destruction of them to a greater depth than this is unnecessary. This method of treatment was first had recourse to, if I remember right, by Mr. Welbank, who wrote a very interesting paper on the subject.

I have taken this opportunity of speaking of some of the principal cases in surgery to which the destruction of parts by caustic is applicable; but you will find a great number of others in practice in which you may employ them with advantage. I need not, however, occupy your time further on this part of our subject. The observations which I have already offered will be easily applied to other cases; and will, I trust, be found sufficient to initiate you in this department of surgery.

DESTRUCTION OF PARTS BY HEAT:—THE ACTUAL CAUTERY.

The organization of the living body may be destroyed by the application of intense heat. A moderate degree of heat does not at once destroy vitality: it produces a peculiar kind of inflammation, with vesication of the skin; but a great degree of heat destroys at once the vitality of the part to which it is applied. Of course, the action of heat is altogether chemical. No part will live if its organization be destroyed; and heat destroys the organization. There is one thing worthy of notice respecting the slough made by a hot iron: it is separated sooner than the slough made by caustic—that is, the two sloughs being of the same extent, that which is made by a hot iron is separated at an earlier period than that made by caustic.

The reason of this is sufficiently evident. If you look at the injured part there is a much greater degree of inflammation round the slough made by the former than there is round that made by the latter.

The destruction of a part by the application of heat to a small extent is attended with no constitutional disturbance; but if it be to a great extent, the constitution is affected in proportion to the quantity of parts destroyed. This, however, is remarkable—that where on the surface of the body there is an absolute destruction of the skin by intense heat, the constitution often suffers, in the first instance, much less than if a slighter degree of heat had been applied to the same extent of surface. You will have frequent opportunities of verifying this observation, if you watch the comparative effects of burns and scalds in the cases admitted into the hospital. I have been surprised sometimes to find, where a great deal of skin has been completely destroyed, how little the constitution has resented the injury immediately after it had been inflicted; but it resents it enough afterwards, and when the period arrives at which the slough should be thrown off, then the general system suffers. I remember a lady who had both her arms burned, so that nearly the whole skin of each upper extremity was completely dead; yet her constitution seemed almost unconscious of the shock. When, however, the time came, at which the slough should have been separated, she began all at once to sink, and died in a day or two.

The actual cautery may be used for surgical purposes on the same principle as caustic; and there is one occasion on which the former will certainly do what the latter will not effectually accomplish—it will stop hæmorrhage. In some cases of dangerous hæmorrhage from a great quantity of small vessels, or from large vessels, which cannot be secured on account of their being deeply seated, the actual cautery is very serviceable. I have often found it useful on these occasions; but otherwise I have not much had recourse to it. I have indeed employed it on other occasions formerly, but I did not find it do any thing which caustics would not have done as well or better, and it is much more alarming, much more frightful both to the patient and to bystanders. It was the habit of surgeons here fifty or sixty years ago, to use the actual cautery to a great extent, and it appears to be one of the many proofs of the advancement of English surgery that we have got rid of this rude piece of farriery.

MORTIFICATION FROM ANIMAL POISONS.

I mentioned in a former lecture that I had seen a man who died of extensive sloughing of the cellular membrane, after the sting of a bee. I stated that I had attributed this chiefly to his being of a bad constitution, though, perhaps, something might be attributed to the influence of the animal poison. My reason for making the latter observation was this: there are certain animal poisons which have the effect of producing mortification, especially of the cellular membrane. There is a work of the Abbé Fontana, in which he describes

a great number of experiments on the smaller animals, made with the poison of the viper, and the principal local effect that he observed was gangrene of the bitten limb. When I was first assistant-surgeon, a man was brought into this hospital under the following circumstances. A rattlesnake was exhibited as a sight in Piccadilly, and this poor fellow went to see it. He was a carpenter, and having dropped his rule into the rattlesnake's cage, he introduced his hand to take it out, and the snake bit him. He was immediately brought to the hospital, in a state approaching to that of syncope, with violent pain extending up the arm. The next day the whole arm was swollen, and the skin looked purple; there were vesications upon it as if sloughing were going on in the subcutaneous cellular membrane. The man lingered here for nearly three weeks, and then died. At the time of his death, there was extensive mortification of the skin of the forearm: and the whole of the cellular membrane, from the bitten finger up to the shoulder, was in a state of slough. From the appearance in the beginning there could be no doubt that the sloughing process of the cellular membrane had begun immediately after the injury was received. The skin itself seemed to have mortified only because it lay over the dead cellular membrane; and what is curious, the muscles underneath were not at all affected. The poison seems to act, as far as its local operation is concerned, especially on the cellular membrane. Not only was this proved by this particular tissue sloughing so extensively, but it was also proved by this circumstance, that within an hour after the bite extravasations of blood (ecchymoses) might be traced in the cellular membrane as high as the shoulder, thence downwards on the side of the chest as low as the false ribs, presenting altogether a very singular appearance. The poison, indeed, seemed to operate on the cellular membrane neither in the direction of the nerves, nor in that of the absorbents, nor in that of the blood-vessels. In fact, it is difficult to explain the local effects produced by this virulent poison from the anatomical structure of the parts, or on any known physiological principles. I am in possession of the notes of an experiment made by the late Mr. Ewbank (who died some years ago, having been my colleague in the hospital) with this same rattlesnake. A rabbit bitten in the shoulder became affected by the poison in a few minutes, and died at the end of three-quarters of an hour. Even in this short space of time the cellular membrane, to a great extent, was in a state of slough, although the skin and the muscles were not affected. There are several other animal poisons that seem to operate in the same manner.

I have only one practical observation to make on these cases, namely, that you may prevent the extension of the mischief produced by the animal poison, by the application of a ligature round the limb above the bitten part. It seems to stop the influence of the poison upon the cellular membrane, and at the same time to prevent the poison entering into the circulation and affecting the general system: for in these cases, besides its local operation, the poison has a powerful influence on the constitution. The constitutional symptoms,

however, are not to our present purpose, and therefore I shall not describe them.

MORTIFICATION FROM EXPOSURE TO COLD.

As parts may be killed by excessive heat, so they may be killed by excessive cold. You might suppose that cold would produce the death of a part in the following manner: that it would freeze it, and that the fluids being frozen, and to a certain extent expanded in the act of freezing, the organization of the capillary vessels would be destroyed, and death of the part ensue in the same manner as in plants and trees, which are killed by a severe frost. Two or three years ago, when there was some very mild weather, like that of spring, about Christmas, in many places the sap began to circulate in the evergreen trees. But this premature spring was followed by some days of most intense cold. The sap was suddenly frozen in the vessels of the alburnum, and as it froze it expanded, and burst the vessels, and killed the trees by destroying their organization. I said that you might suppose at first that death from cold is produced in a similar way in the animal body. I cannot say that such never is the case, but I do not find that that is the way in which it usually happens. When a part is frost-bitten it is not in general killed at once, but after being exposed to a warmer temperature, it inflames, and the inflammation immediately terminates in gangrene. I imagine that the influence of cold upon the animal body is scarcely ever so instantaneous as at once to freeze the fluid in the vessels; there is almost always time for these to contract and become emptied of their blood before the parts are frozen. You may see this in your own fingers, when they have been exposed on a cold day, they become quite shrunk and pale, as if there were no blood in them, and may remain in this state for a very long time. If in a case of frost-bite, you go to the fire to warm the affected part, there is a sudden reaction, inflammation is set up, and mortification follows. In this country we have very little experience in these cases. Every now and then, indeed, a patient is brought into the hospital who has lost a part of his foot, perhaps two or three toes, in this manner, but not until some time after the mischief was done, and we therefore do not see the process by which the death of the part has been produced. There are, however, abundant accounts of death from frost-bite, written by persons who have been in climates colder than ours. I may refer especially to a work by M. Beauprè, a French physician, who followed the Emperor Napoleon, in the Russian campaign. By his account, it would appear that parts may be under the influence of cold for a great length of time, so as to be completely deprived of sensibility, and yet, with prudent management, may recover perfectly. He states that he has frequently had his foot benumbed while riding on horseback, so that for a long time it has been devoid of sensation, and that he has got off his horse without knowing whether his feet touched the ground or not; but by rubbing them

with snow, and thus very gradually restoring them to a proper temperature, the evil consequences of frost-bite have been prevented.

MORTIFICATION FROM SUDDEN LOSS OF BLOOD.

As the circulation of arterial blood is necessary for the maintenance of life, so whatever for a considerable time prevents a part of the body from being supplied with blood, will produce mortification. A very copious blood-letting, for instance, will, under certain circumstances, give rise to it. I will mention a remarkable example which fell under my observation some years ago, in a case which I attended with the late Dr. Babington. The patient, a medical officer in the East India Company's service, had gone out to dinner, and drunk an immense quantity of wine, so that he got exceedingly tipsy. This was in the city. He staggered up Holborn as well as he could, and found his way into a chemist's shop. Here he was mad enough to ask the person who stood behind the counter to bleed him, and whether this person was tipsy or not also I do not know, but however that might have been, he certainly did bleed him: and not only that, but these two blockheads agreed that he could not be bled too freely; and so this drunken man lost, I believe, not less than three pints of blood. He then became exceedingly ill, was carried home in a coach, and the next day both his feet were mortified; the toes and feet up to the instep. We gave him wine and nourishment; he recovered, the sloughs separating, the dead bones coming away, and the stumps of the feet healing.

MORTIFICATION FROM INFLAMMATION OF ARTERIES.

Any thing which obstructs the passage of blood completely through the arteries of a limb, will, of course, produce mortification. A single ligature placed on an artery does not do it, because it stops only the main trunk at one point, and there are anastomosing vessels communicating with the artery above and below the ligature, which are sufficient to carry on the circulation. But supposing that, instead of one ligature, you were to put on half a dozen, at different distances from each other, in the space of six or seven inches of the artery you would not only render the arterial trunk, but the anastomosing branches also, incapable of carrying on the circulation, and this would produce gangrene. I imagine that such a thing never was done by a surgeon upon the human subject, but something corresponding to it may happen from disease. As long ago as when I was house-surgeon in this hospital, I went to see a poor man at Brompton, under the following circumstances. On a very hot summer's day in August, he was walking in the fields, when he felt a sense of pricking, numbness and weight, as he described it, in both lower extremities. It was with great difficulty that he crawled home. In one of the lower extremities these sensations subsided, but not so in the

other. On the following day the whole of one leg, and the thigh as high as the middle, were in a state of mortification. The mortification never extended afterwards, no vesications formed on the foot, it was not swollen, and no part became putrid except just a little in the middle of the thigh where there was a great mass of soft parts. The limb dried, the skin assuming a brownish colour, being at the same time hard and semi-transparent, so that the white tendons could be seen shining through it. It was, in fact, what has been called a case of dry gangrene. The poor fellow went on very well for four or five weeks, without any bad symptoms, during which time the separation of the dead parts in the thigh had made considerable progress. But it seemed to be more than nature could accomplish to complete the work. His powers at last began to fail, and he died at the end of six weeks from the commencement of the attack. I examined the body, and found marks of inflammation everywhere about the principal artery and vein of the limb. From the bifurcation of the iliac trunk down to the middle of the thigh, the artery was obliterated, being completely filled with coagulated lymph evidently effused from inflammation: closely adhering to the inner surface, but with some admixture of red coagulum. The vein was filled with lymph, and obliterated in the same manner as the artery. There had been inflammation of the sheath of the vessels, in consequence of which the artery and the vein adhered closely to each other and to the surrounding parts, so that the dissection was somewhat difficult. I suppose that the nature of the case is plain enough. There had been inflammation of the artery and the vein, and the obliteration of the artery was to so great an extent as to cut off the supply of blood, not only through the trunk but through the anastomosing branches. Some years ago, I was called with Sir Charles Clarke, and Mr. Bryant, of the Edgeware Road, to see a similar case, which terminated more fortunately. A lady, without any apparent reason, was seized all at once with pain in one groin, and down the anterior and inner part of the thigh, with great tenderness in the course of the femoral artery. When I saw her, which was not till some days afterwards, the whole leg below the middle was in a state of mortification. There was no œdematous swelling of the foot, and no vesication. She had still pain in the course of the femoral artery, which was aggravated by pressure; and the pulse could not be felt either in the groin or lower down. Considering the resemblance of this case to the one which I have just mentioned, I could entertain no doubt that the disease was similar, and that the mortification of the leg was the consequence of arterial inflammation. After some time the soft parts began to separate, until at last the lower part of the leg and the foot remained attached to the rest of the limb, merely by the tibia and fibula. I sawed through these bones, after which the parts gradually healed, forming a very fair stump. Perhaps you will ask why I proceeded in this manner, instead of amputating the limb at once. The fact is, that I remembered a case published in Saviard's Observations on Surgery (Saviard was a celebrated French surgeon in the early part of the eighteenth century),

which was very similar to this which I have just mentioned, and in which he amputated the thigh. In performing the operation he was surprised to find that no blood flowed from the stump, in consequence of the vessels being obliterated. The parts divided in the operation had not a sufficient supply of blood for the healing process. The stump mortified as the leg had done before, and the patient died. It appeared to me, after the evidence afforded by this case, that it was desirable to avoid an operation if possible. At the same time I ought to mention, that in the second volume of the Medical Observations and Inquiries, there is an account of a case, apparently of the same kind, in which amputation was successfully performed, the stump healing favourably.

One of the circumstances most deserving of notice in these cases is that the limb mortifies to a certain extent, and that then the mortification stops. This, however, is easily explained. We know that the obliteration of an artery must prevent the supply of blood to certain parts, but no further. Another peculiarity is, that the parts become dry, hard, horny, which condition of them has given rise to the name of dry gangrene. This is also easily explained. If mortification be the result of inflammation or of venous obstruction, there is always an effusion of serum before the parts completely die, in the form of vesication of the skin, and œdema of the cellular membrane; and then, when the parts die, being infiltrated with serum, they readily become putrid. But here the supply of blood is cut off; the blood is prevented from entering the limb, so that there can be neither vesication nor effusion of serum into the cellular membrane; and the dead parts dry readily from the absence of moisture. M. Dupuytren has described the gangrene that occurs in old age as the result of arterial inflammation, but I am quite satisfied that he is mistaken on this point. Gangrene from arterial inflammation is a comparatively rare disease, and may occur at any period of life; whereas, the gangrene of old age arises, as repeated dissections have enabled me to determine, entirely from other causes. I shall offer some observations on this kind of gangrene in the next lecture.

LECTURE VIII.

ON MORTIFICATION. (*Continued.*)

SENILE GANGRENE.

PERSONS advanced in life are liable to mortification of the toes and feet; generally beginning in the former, and extending to the latter. By persons advanced in life I mean those who bear upon them the marks of old age, which may, however, occur at various periods of human existence. One of the worst cases of mortification

of the toes which I ever witnessed, connected with what might truly be considered old age, occurred in a man of six-and-thirty, worn out by the operation of bad habits upon an originally bad constitution.

The question here arises, *in limine*, why is it that old persons are liable to this disease? Morbid anatomy enables us to answer this question. I have examined the bodies of a great many old persons who have died with mortification of the toes, and I have always found some morbid condition of the arteries of the affected limb. In the great majority of cases there is extensive ossification of the arteries of the thigh and leg. In many cases the arteries are not only ossified, but some of them are contracted and obliterated. Thus I have known the femoral artery to be obliterated from the origin of the *profunda* down to the ham. In other cases one or more of the arteries of the leg are obliterated, while the femoral artery is still pervious. In one case, of which I have preserved notes, the arteries were not ossified in any part of their course, but the femoral artery was converted into a gristly cord, and quite impervious from the origin of the *profunda* to the point at which it perforates the tendon of the great head of the triceps adductor muscle. In none of these cases, in which the arteries were contracted and impervious, were there any such appearances as would have indicated that the contraction had been the result of previous inflammation; and it appeared to me that the change which had taken place in their condition was best to be explained by supposing it to be the result of a process corresponding to that which produces stricture of the urethra or œsophagus.

It has been said that mortification of the toes in old persons is often the result of disease in the heart itself. This does not, however, exactly correspond with the results of my own experience. It is true, that I have known persons who had disease in the heart to die of mortification of the toes; but then there was always enough in the condition of the arteries of the limb to account for the mortification independently of the other disease. Thus in one case in which there was mortification of the right foot, the muscular structure of the heart was soft, thin, flaccid, and easily torn; one coronary artery was impervious; and the right iliac artery, for the extent of three inches, was impervious also, in consequence of it being completely filled by a mass of firmly coagulated blood. In another case, in which there had been mortification of the right foot, the muscular structure of the heart was pale and flaccid; one coronary artery was contracted and impervious; the cavities were dilated; a mass of dense coagulum, resembling that found in the sac of an aneurism, occupied the appendix of the left auricle, and there was a similar coagulum obstructing the popliteal artery and vein of the right side, and extending some way down the branches of those vessels in the leg.

You are not, however, to suppose that mortification of the toes is a necessary consequence of ossification or obliteration of the arteries, and that it occurs in all such cases. I have no doubt that many persons have the arteries thus altered in structure for many years, although mortification never supervenes. I have already explained