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COURSE
OF
LECTURES ON PHYSIOLOGY AND
SURGERY,
DELIVERED AT ST. GEORGE'S HOSPITAL,
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(From the Manuscript of Dr. Thomas Shute.)
LECTURE VIII.
SUPPURATION.

IN suppuration the process is always the same: nature, before it begins, sets bounds to it by adhesive inflammation. It is not caused by the air, which is generally said to produce it. It is uniformly the same, whether it arises from external violence, the constitution, or some disease of the part. Violence alone is not sufficient to produce it; for instance, in a wound, if the parts are brought into exact contact, they will unite and get well without any suppuration; but if the parts should remain exposed for a certain length of time, then suppuration follows. It is the exposure, therefore, which causes suppuration, and not the injury. Exposure however, is not always necessary to suppuration, for matter forms without it, as in abscesses. Although violence simply is not sufficient to produce it, yet where violence is such as to produce the death of a part, or to render it incapable of performing its functions, the suppuration becomes necessary for its removal.

That air does not produce it, is proved by the following circumstances:—Birds have cells in their bones, which communicate with their lungs, so that if the os humeri of a hawk is cut through, and the trachea tied up, the bird will breathe through the bone, till the adhesive inflammation obstructs the cells. There is the same communication between the cavity of the abdomen and lungs; if the abdomen is opened, and the trachea tied, the bird will breathe through the abdomen until stopped by the inflammation. If air could have produced the inflammation, it should have happened before any wound was made. In birds, the communication of their bones with the lungs is very general throughout; there is a communication also with the spinal marrow, and perhaps with the brain. If the access of air could produce suppuration, it must happen in emphysema. Suppuration occurs in cavities from the stimulus of imperfection being given to them, and which would be produced equally as soon in vacuo as when the air has free access to them. The membranes of the nose and of the urethra have equal access to the air at all times, but suppuration is never produced until they are by some cause previously inflamed. Inflammation arising from a specific disease, is very slow in its progress; but arising from accident is generally very quick. Thus, when an inflammation attacks the breast of

a woman, and advances very rapidly, we may be at once certain that it has no cancerous tendency. Suppuration is naturally very violent, it is a great effort of the constitution to change the adhesive inflammation to the suppurative. This change frequently is very sudden. The quicker the suppuration advances, the more healthy it is: therefore where it takes place, it should be promoted as much as possible.

Symptoms of Suppuration.

The symptoms of suppuration are those common to inflammation. We have a great variety of sensations: pain seldom exists alone without other sensations accompanying it. Therefore people in common language will express their different feelings by different terms, to convey their ideas; thus they say that a part is sore, or that it is a heavy pain, or a numbed, or like the gnawing of rats, &c. And whenever pain exists, it generally gives an idea of the disease. Thus, in suppuration, the sensation gives an idea of its nature: it is attended with a sore pain of the most simple kind, pain unmixed with any other sensation; other diseases have something joined with this pain. The pain is greatest at the dilatation of the arteries, therefore the pulse may be counted by the throbbing of the part, which is the most characteristic mark of the disease. As the suppuration advances, the skin becomes of a pale scarlet colour. The surrounding parts also become œdematous. These appearances are from the adhesive inflammation preceding the suppurative. Exposed parts always suppurate; but exposure is not always necessary to suppuration.

The change from lymph to matter is very gradual. First, coagulable lymph is secreted, which secretion gradually alters its fluid, till at last it forms pure pus. None of the fluids undergo any change after their secretion. Lymph and pus are therefore found together in an abscess. This has introduced an idea among surgeons, that abscesses ought not to be opened until the matter is concocted, because they have observed, that when they have been opened early, lymph has been discharged. All their attention has been given to the matter without considering the parts surrounding it. The alteration in the disposition of the constitution is very sudden: it produces shiverings. But the change produced in the action of the vessels of the part is very gradual—therefore the slow change from lymph to pus.

Suppuration begins in the surfaces of the cells of the cellular membrane, first forming coagulable lymph, then pus in the same manner as in empyema. When inflammation has so far destroyed or injured a part that it cannot go back by motion to its former action, then suppuration begins. The disposition of the vessels in suppuration is very different from that of inflammation, which is shown in granulations; for if they are stimulated,

the adhesive inflammation comes on, which at once stops suppuration, and the progress of their growth. Suppuration and ulceration are two very different processes, frequently taking place at the same time, in one and the same part. Suppuration is sometimes stopped by the constitution, and the matter which has been formed is absorbed. Matter formed in buboes is sometimes absorbed. This frequently happens in scrofulous abscesses; the parts lose their disposition for forming matter; that which was formed is absorbed, and the parts get well without the adhesive inflammation taking place. No opportunity has yet offered to examine in what state the parts were left.

Matter is probably perfectly innocent, and not a deposit of morbid humours. It may be repelled into the constitution without doing any mischief.

Treatment of Suppuration.

The use of suppuration is not well understood: granulation is not a necessary consequence of it. To know how to prevent suppuration would be one of the most useful discoveries in surgery, for it often is the cause of death; as in suppurations of large internal cavities; the thorax and abdomen, &c. It is doubtful whether any application will hasten suppuration. Some applications may hasten ulceration, and by that means bring the matter to the surface quicker. Parts that are indolent require stimulating to produce a good suppuration. Poultices do not ripen, and can only act by soothing the part. Absorption of matter is a principle of the animal economy which sometimes takes place. Whenever we can catch any principle of the animal economy, we ought carefully to attend to it, that it may be made use of to advantage. We have less power over the absorbent system, than any of the vessels.

If matter be formed in a venereal bubo, it is best to disperse it if possible, for although the virus is carried into the constitution, it prevents pain and a troublesome wound. The virus may be destroyed by its specific remedy. When suppuration is slow it is right to hasten it, for the quicker it is formed the better it will be. The cure afterwards will be performed the better. Every operation of the constitution is performed best when it is quick. Stimulants when they are applied to a sore do not appear to increase the discharge of matter, therefore they cannot be supposed to increase suppuration, although they may ulceration. Ulceration is in proportion to the degree of inflammation; the greater the inflammation the quicker the ulceration is performed. Inflamed parts are easiest when kept moist, therefore a poultice will give ease to an abscess when the matter is near the skin, by softening the stretched cuticle. The pain in a great degree arises from the dried cuticle binding the cutis.

OF PUS.

It is one thing to know the operations of nature, and another to know how she produces such effects. A man who perfectly understands mechanics may, by examining a watch and taking it to pieces, be able to tell the motion of every wheel, and the ultimate end of all their motions; yet he may not know how that watch was made—the manœuvres of the watchmaker in making the several parts.

It is difficult to say how parts make pus; the same vessels discharge it as before discharged lymph, but their actions must be considerably altered. When it is first formed by the vessels, it is of a darkish yellow colour; the same vessels gradually change the colour of their secretion, the pus becoming whiter and whiter, until it looks like cream, which is called laudable pus; it also becomes more viscid. Its changes may be observed on a stump; when the bleeding is stopped, if dry lint is applied, it will be glued to the wound by the coagulable lymph which exudes from the exposed cells; after a time these cells secrete pus which will throw off the lymph, and of course the dressings which adhere to it.

Nothing can be found in the blood similar to pus. It is a more complete secreted fluid than many others in the body; the tears seem to be nothing more than serum with a little sea salt.

Extraneous substances are to be found in pus, as they are found in the blood and secretions, as iron, salt, &c. These extraneous substances pass off with pus as with other secretions, but they do not enter into the composition of the secreted fluid. For the secretion of pus, probably new vessels are often formed. They may be called glandular. Solids do not enter into the composition of matter. It has been generally supposed that matter was formed by fluid and solid particles; the fluid destroying or converting the solids, which it was in contact with, into a fluid similar to itself. It is usually called a melting down of the solids; which, if true, it would be difficult to conceive that granulations could be formed, yet we find that they form the best pus. It is absurd to suppose a part forming a matter which is continually destroying itself; but it is easy to look on one side of the question, and not on the other. The peculiar qualities of pus are its colour and consistence. When it is good its colour is white, very much resembling cream. When viewed in a microscope it appears to be composed of opaque globules swimming in serum; it derives its colour from these globules, each of which when separated from the rest are white. This whiteness is owing to the opacity of each particle, and not to a number of transparent bodies particularly arranged, which will occasion whiteness, as we see in the froth of water, &c. The greater the proportion of the globules to the serum, the better is the pus.

Pus is probably a decomposition and new combination of the blood.

Though it appears like cream, it has not perfectly the same properties. Cream is an oil and mucus combined: by churning, it is deprived of that combination and becomes butter. In melting butter cooks add flour, which forms mucus to combine it, and prevents it from turning to oil. Perhaps pus is not only composed of serum and globules, but has also some lymph, for it in part coagulates. The proportions depend on the health. In bad matter there are few globules. It always shows the state of the solids.

When a cow calves, her milk is at first very thin, there being few globules in the serum. The proportion of globules gradually increases from the time of calving. If the cow is milked for two years, the milk will be almost entirely composed of these globules, being almost all cream. If an incision is made at this time into the udder, the milk will become thin. It will also change its

consistence if the cow is milked too near her time of calving, for then it changes from the thick to the thin consistence.

Pus always possesses the specific property of the part which secretes it—as in the small-pox, venereal disease, cancer, &c. It is no stimulus to its own sore, being always in perfect harmony with it: if it was not, it would be impossible for the part to heal. The extraneous substances which are sometimes contained in it, as in other secretions, may stimulate the sore: sometimes it excoriates the surrounding skin. The structure is the same which secretes pus and forms granulations.

Good pus is itself perfectly sweet, but under some circumstances becomes putrid—in recent sores, and when mixed with blood, which becomes putrid sooner than pus. It also has a greater tendency to putridity when the part is inflamed. In specific diseases it is soon putrid. It is also perfectly sweet in an abscess, unless it is situated near the colon or rectum, or near the lungs, so that the air has access to it. In diseased sores it has the greatest tendency to putrefaction. When discharged from a diseased bone it is very fœtid. From its appearances answering to the disposition of its ulcer, we are enabled to judge of the state of a wound when it is out of sight.

The idea of a translation of matter is absurd, it can never move from one part to another as it is supposed. An induration may be removed by causing the part to suppurate. Sir John Pringle has made an experiment to prove that pus is formed from serum: he placed some of this fluid in a heat equal to animal heat, and after a time he has seen something falling to the bottom like pus. This was only the beginning of putrefaction. It being like pus is no proof at all: it may as well be said that glass is crystal, because it resembles it in many respects. If lymph or serum formed pus, the adhesive inflammation could never take place: the extravasated fluids must produce matter instead of cohesion. We are unacquainted with the use of pus.

OF ULCERATION.

The arteries are the vessels which carry the blood to every part of the body, to furnish it with matter for its growth, nourishment, and the secretion of fluids; and also to the excretories, where the parts are thrown off which have become useless. The veins at present are supposed to be entirely passive; they having the office of only carrying the blood back again to its reservoir, that it may go the same round.

The absorbents are another complete system of vessels, which may be called the modellers of the body. Their uses hitherto have not been completely explained. If it was not for these, we should have the bone of an adult very different from that of a fœtus.

The actions of this system of vessels may be divided into, 1st. that of modellers; the taking up of healthy parts to regulate their form, as in the growth of bones: 2nd. the absorption of chyle for nourishment: 3rd. an absorption of parts in consequence of disease. This last may be divided into two kinds. 1. A general emaciation from disease, or from a partial wasting, which sometimes happens to a limb from some injury of its tendons or ligaments, thus causing a partial consumption.

2. The removal of some complete part, as in the spina ventosa. This may properly be called ulceration.

It may be difficult to conceive how a body should remove parts of itself: but it is as difficult to conceive how a body should form itself. Ulceration is caused by irritation. Any other means must be mechanical or chemical, which is not an operation of the animal economy. All its operations arise from the actions of the living principle. Ulceration may be divided into two kinds:—1. That which is attended with suppuration; 2. That which is not a consequence of suppuration, or attended by it.

The 2nd. species is seldom attended with pain, and sometimes with no visible inflammation. It seldom affects the constitution. The cause of its not being painful, is the slowness of its operation; not being sufficiently quick to come within the medium of time which produces pain. It is this operation which separates sloughs, and causes bones to exfoliate. It is caused by pressure—of which there are two kinds—one endowed with life, the other not. A much less degree of internal pressure will cause ulceration, than that which is external; and it is necessary that it should be so, for it is proper that parts offending should be let out as soon as possible. But such as are without and pressing inwards, their nature thickens the parts, giving them additional strength to resist the injury. If the pressure is so great that the parts cannot support it, then nature removes them by ulceration out of the way of the pressure.

This species of ulceration may be observed in an aneurism of the aorta at its curvature. As the aneurism enlarges the parts surrounding it are taken up; at length the coats of the artery come in contact with the vertebræ: the pressure now being on both sides; within by the blood and without by the bones, the coats of the artery are soon taken up; and after that the bones themselves. This ulceration is preceded by the adhesive inflammation, which as the ulceration advances keeps going before, let the thickness be ever so great. This is particularly beneficial, for otherwise the blood would soon extravasate into the cells of the cellular membrane. It rarely happens that an aneurism bursts internally.

A highland soldier in the Dutch service had a tumor on the pia mater, between the convolutions of the brain: the tumor gradually made its way to the surface, the dura mater, bone and the scalp being gradually absorbed. This could not be produced from pressure, for action and reaction are always the same: the tumor was a living part, and there was no appearance of ulceration upon it, or of suppuration. Parts endowed with simple life, and producing ulceration by their extraordinary pressure, do not cause suppuration, whereas those which are entirely extraneous produce it. The ulcerative stimulus is always next the surface. In spina ventosa the bone becomes enlarged from the pressure of coagulated blood contained within it.

Absorption must act from a stimulus. A sense of weakness in a part becomes a stimulus. Debility, therefore, appears to be a cause of ulceration. When a part becomes so weak that it cannot support itself, the stimulus is given to remove it.

The adhesive inflammation always attends ulcera-

tion: the use of it is to bring the matter or substance to the surface. If matter forms in the middle of the thigh, the adhesive inflammation surrounds it to a certain distance: as the ulceration advances towards the surface, the adhesive inflammation keeps going before it: if it did not, when the ulceration had got through the first adhesions, the matter would get into the cellular membrane, and could never arrive at the surface. Thus ulceration leads it to the surface, and the adhesive inflammation goes before to prevent its diffusing. This process is attended with soreness, something like the pain caused by a cutting instrument.

Some ulcerations of the specific kind are attended with little pain: sometimes, however, they are attended with a great deal of pain, but then the suppuration is very quick.

Ulceration seldom, if ever, affects the constitution, not producing rigors, fever, &c.

The separation of dead parts from the living, is attended with very little pain.

Some parts are more susceptible of ulceration than others. The cellular membrane more than any other part: in this a very slight degree of internal pressure will produce it. A milk abscess, when it has burst at the superior part of the breast, will sometimes ulcerate afterwards at its most depending part, from the pressure of the matter which lodges and produces a second opening at the inferior part of the breast, and thus the two openings have communication.

Granulations, from appearing very florid and healthy, often suddenly become altered, having an ulcerated appearance; when this is observed, the surgeon may be certain that his patient has suffered a great deal of pain, there being nothing so painful as ulceration. The parts susceptible of ulceration are those situated between the extraneous body and the skin. The extraneous body does not always go in a direct line to the surface, because parts that are but little susceptible of ulceration being in the way, it rather chooses to follow the course of the cellular membrane, as when parts are covered by a strong fascia. The skin is much less susceptible of ulceration than the cellular membrane; therefore, when abscesses break, we frequently have the cellular membrane hollowed out for some way underneath, the skin hanging over.

ILLUSTRATIVE CASE.

A gentleman was wounded by a small sword, which penetrated the abdomen below the navel, which wound healed up. Six weeks after the accident, he had a large tumor at the superior part of the abdomen, in which matter formed; it was opened, and the discharge killed him. On opening the body, an adhesion was found between two of the intestines, opposite the wound, which was supposed to be caused by one or both of them being scratched. The matter which formed above was unconnected with the wound: it was formed between the epiploon and peritonæum: the great arch of the colon adhered to the epiploon: the matter had passed through the peritonæum, abdominal muscles, and three inches of fat, to make its way to the surface, although it would not have had above half an inch to get through the intestine. Thus, when matter forms near a cavity it makes its way to the surface, notwithstanding the great difference of the thickness. Many similar cases

have been related by surgical writers—some by Le Dran. Matter on the lungs will sometimes make its way to the air-cells. An abscess on the trachea will often open into it.

The ulcerative process has no power over the cuticle, therefore the matter forces its way through it. This causes abscesses on the hand and sole of the foot to be so extremely painful: the thickness of the cuticle preventing the matter from coming through. Nothing is more painful than a whitloze from the inflamed part being tightly bound by the thickened cuticle, as by a bandage—bread and milk poultices are nowhere more useful than in this disease, they soften the cuticle by their moisture, relax it, and give great ease to the inflamed cutis. In these cases the cuticle is frequently separated from the cutis for a great length. Ulceration often arises from the disposition of parts. In Anson's voyage, the callus of long standing was taken up, and old cicatrices became ulcerated. New-formed parts are most susceptible of the stimulus of weakness, therefore old sores frequently break out. Suppuration follows ulceration immediately. If a part is removed by the knife, the wound will be three or four days before suppuration commences: but if the same is removed by ulceration, suppuration immediately follows: from this it appears that the parts are prepared for suppuration previous to ulceration, which may perhaps be done by the adhesive inflammation which goes before the ulcerative. A wound when ulcerating appears full of holes, is foul, and the discharge ichorous, the skin scolloped with its edges turned outwards. In digging a hole in the ground the part dug appears full of holes, and the earth thrown out on the side full of heaps. In like manner it appears in wounds; when ulcerating, full of holes; when healing, full of heaps.

In the treatment of ulceration we ought to hasten it as much as possible, if we want to bring parts to the skin; for which purpose warm poultices and warm plasters are applied, such as diachylon with gum, &c.: these by stimulating will hasten ulceration.

Topical applications have little effect in preventing ulceration. If it arises from weakness of the constitution, strengtheners must be used; if from increased action, where there is great strength in the constitution, then soothing means must be used: opium externally applied is the most powerful of these. If from a specific disease, then the specific remedy should be used, for no other medicine will have any effect. If there be no specific remedy, as in the scrofula, then other means must be tried: opium might be used as an experiment, but probably it would do no good, perhaps rather harm, for this disease has something sedative in its nature. Some ulcerations about the skin are very difficult to cure; this frequently happens between the toes, spreading from one to the other, and about the feet; as soon as one heals another breaks out, and so on for a twelvemonth or longer, resisting everything, external and internal. These cases have given way more to opium topically used than anything else.

When suppuration begins in the centre of a part, it does not know which way to go, therefore it sometimes takes one course, at other times another, as in psoas abscess. It turns out of a direct course when parts obstruct it which are

difficult to ulcerate, therefore we find it rather taking the course of the cellular membrane, than going through a muscle or blood-vessel, dissecting parts as it were in its course. If matter be formed, and there be a part situated within the cavity which presses on that side next the surface, it will ulcerate there, let the opening be made in any other part. Thus, if a large quantity of matter be formed upon the elbow and about it, the elbow will come through the integuments even when a dependent opening has been made, and granulations are formed. In like manner when matter has formed about the trochanter, let the opening be made where it will, the bone will come through the integuments, which is a case that frequently happens.

These cases show how slight a degree of pressure internally is sufficient to produce ulceration, for the skin is ulcerated from the pressure of granulations which are growing on the trochanter, they appearing healthy everywhere on its surface.

ON THE
PHYSICAL ALTERATIONS OF THE BLOOD
AND
ANIMAL FLUIDS IN DISEASE.

By M. ANDRAL.

No. VII.

Temperaments; anæmia; general observations on the changes of the blood which take place in fevers and inflammation.

SANGUINEOUS TEMPERAMENT; PLETHORA.—As certain forms of disease consist merely in excess of temperament, it is proper to examine the conditions of the blood in various temperaments; there is no other difference than one of degree between the sanguineous temperament and plethora, whether natural or morbid. Considerable influence has been attributed to the blood in the production of temperaments; people are said to be sanguineous under the supposed idea of an excess of blood; the influence of other fluids is expressed by the terms bilious and lymphatic. The sanguineous temperament is a condition of the system which, when much increased, constitutes plethora; people of this temperament are usually very strong, and all their functions are extremely active; it has been affirmed that they have a greater quantity of blood, and that the latter is more rich than the blood of other persons; as proof of this, the existence of a large clot with tendency to buff, has been cited, as indicating an increased quantity of fibrin. But, in the first place, we cannot affirm that sanguineous persons have more blood than others, since the normal quantity of that fluid in the human body is unknown. From the observations of M. Andral, however, it would appear that the solid elements of the blood are increased while the serum is diminished. In the second place, we cannot rely on a simple inspection of the clot; we must determine if it be the fibrin which is increased, or the other elements of the blood; it is generally thought that it is the fibrin, but this idea is far from being correct. Neither the fibrin nor the albumen are increased in the sanguineous

temperament, but the globules, which may augment from 127 to 140; beyond this latter we have a state of disease.

If the blood be examined before coagulation, it presents a deep-red colour, depending on the increased quantity of globules; the clot is large for the same reason, and because a good deal of serum is retained by the globules; but the firmness of the clot is not augmented, as people generally believe. One of the chief characteristics of plethoric blood is, that it never presents a perfect buffy coat; a circumstance explained by the small quantity of fibrin compared to the globules.

The signs of the plethoric habit are normal or morbid. All the functions are remarkably active; life is, as it were, in excess, from the excess of blood globules; the digestive process goes on rapidly; the respiratory apparatus is developed, and the capillaries always injected; hence the bright colour of the cheeks, lips, skin, &c. The heat of the body is high; cutaneous transpiration and the secretion of urine active; the urine is deeply coloured, and charged with salts. The passions are strong and easily roused, but though the brain be very active, the sensibility is not great, as in persons of nervous temperament; nervous symptoms do not belong to the sanguineous temperament; it appears that while the blood globules increase, the sensibility diminishes, a circumstance exactly the reverse of what takes place in chlorotic patients, whose sensibility is extremely acute; hence we may conclude, that an augmentation of the quantity of the globules produces an unusual activity of all the functions, save those of the nervous system.

The morbid signs or effects of plethora are of three kinds, viz. congestion, hæmorrhage, and fever. We all know how readily congestion of the brain occurs in plethoric persons; hæmorrhage, also, frequently takes place in the tissue of organs, or from the mucous membranes. The globules being increased in quantity, the normal proportion between them and the fibrin is changed, and the cohesion of the blood is lost. The acceleration of the pulse seems to depend entirely on increase of fibrin. Plethoric persons are not more disposed than others to inflammation, as has been generally supposed; indeed, they seem to be less disposed; but when inflammation does occur, it acts on a system in a state of superexcitement, depending on plethora.

The advantages of venesection in plethoric persons are explained by the condition of their blood. The effect of blood-letting is to diminish the quantity of globules; hence it combats directly the essential element of plethora.

LYMPHATIC TEMPERAMENT. ANÆMIA.—Of anæmia, the general feature is a diminution of strength, and deterioration of several functions; when the lymphatic temperament is carried to an extreme, it leads to scrofula, and not to anæmia. Ancient writers employed the words "lymphatic temperament," to express a condition of the system in which colourless fluids, and particularly the serous part of the blood, predominated. After the discovery of lymphatic vessels, the term was used in another sense, and applied to predominance of lymph in the lymphatic system. In latter days we have returned to the old idea. M. Lecanu tells us, that the quantity of globules is diminished in lymphatic persons; M. Andral coincides with this