the old supporters of the zymotic nature of tetanus thought, some kind of poison resembling strychnine was generated by the bacilli. We may suppose, then, that the bacilli streaming forth from the point of inoculation, as from a centre, distribute themselves through the body, and, further, that each bacillus lying in tissues represents a small but constantly acting source of poison, which first affects its own immediate vicinity, but, as a consequence of absorption and in co-operation with others, affects ultimately the whole body, and we may thus explain the local tone and tension, its gradual extension, and, finally, the affection of the whole system.

It is interesting to consider how these organisms exert their baneful influence on the living bodies of the higher animals. How, for example, do the bacilli of splenic fever act upon cattle? There are clearly four ways in which we may explain the action of microbes upon the infected animal. In the first place, they may act like an invading army on a peaceful population; they may simply consume their stores of pabulum. Possessing greater strength and vitality than the normal tissues, which are highly specialised and perhaps require more complex food—that is, food which has been more or less highly assimilated,—these young and vigorous warriors seize upon and appropriate the raw material, and practically starve out the more delicately framed cells. And this action cannot be overlooked, in whatever mode we may seek to explain their influence. Their enormous rate of reproduction has been already referred to, and we have only to look at the drawings of Klein and others of the thorough infiltration of many organs to understand what a powerful influence they must exert in this direction, and how the normal cells weakened by inanition may fall, like Gulliver before the Lilliputians, victims to the attacks of their minute but numerous and persevering enemies; and, if any further proof were needed, it would be found in the serious effects that are produced upon the economy by any constant drain, whether it be from an imperfectly healed abscess, from leucorrhœa, or even from purulent ophthalmia. Secondly, they may act by interfering with the due performance of the functions of the various depurating organs. Klein, in his numerous and excellent drawings, has frequently represented the kidney, and we see the capillaries of the glomeruli blocked up with myriads of microbes. It is clear that the urea and other final products of the regressive metamorphosis of the tissues must be imperfectly eliminated, and if retained in the body must contribute their share in the development of disease.

But another view may be held. It may be said, so far as we know, all living beings produce excreta, the simplest of which, carbonic acid and water, contain the carbon, hydrogen and oxygen of the food; whilst the nitrogen is eliminated in the form of urea or uric acid or guanin, or some other soluble and generally poisonous compound. Microbes can constitute no exception to this rule; but, whereas in most instances the products of excretion are thrown forth into the vast receptacles of the atmosphere or of the waters or of the soil of the earth, and by the play of other forces become harmless, they are here discharged into the body of the animal on which they are living, and so bring about its destruction more or less quickly, but as surely as if that animal's own excreta were retained in its body.

There is still another explanation which on many grounds has recommended itself, as accounting more satisfactorily for the phenomena observed, both to chemists and biologists. It is that the injurious effects produced by microbes are due, not to what they take or to what they excrete, but to what they leave, and this is closely associated with the imperious demand they make for oxygen. Being in many instances anaerobic—that is, living and multiplying without direct exposure to air—they must obtain the oxygen they require for the process of life from the tissues by which they are surrounded; but when oxygen is withdrawn from such complex chemical compounds as those of which our bodies are constructed, the elements enter into new combinations, and then, under the name of ptomaines (from *πτῶμα*, a dead body), are believed to be the really poisonous agents. Attempts have been made to isolate these compounds; and it has been shown that they are of the nature of alkaloids, and resemble, both in their constitution and in their effects, those deadly poisons that may be extracted from digitalis, conium, tobacco, delphinium, and other noxious plants. In reference to this, it may just be noted that Miquel (*Les Organismes Vivants*, 1883, p. 103) has cultivated a bacterium which has the singular power of converting a gramme of sulphur in the course of forty-eight hours into hydro-sulphuric acid on the addition of four litres of boiling water and some tartrate of ammonium. This bacterium often fixes itself in vulcanised india-rubber tubes, and in the course of a few hours can charge the water they contain with from 60 cc. to 70 cc. per litre of sulphuretted hydrogen.

The difficulty which must strike everyone in regard to the action of these microbes on the body is the comparative rarity of disease. How is it, if the air is swarming with these ferocious microbes, that we do not all succumb to their attacks? How can anyone escape? Pasteur meets the difficulty by stating that the healthy body is capable of resisting the attacks of these foreign agents, and that so long as the surface is intact no harm comes from their ingestion. A healthy man is probably capable of resisting the attacks of the majority of pathogenic organisms, at least for a time. The cells which cover the surface of our bodies and line our alimentary, respiratory and genito-urinary tracts possess their own vital energy, and when perfectly normal cannot be invaded by any microbe; they present an impenetrable front to such organisms along their whole line. When, however, by mechanical, chemical, or other injury the vitality of these cells is lowered, a door is opened for the admissions of such organisms, which, having once penetrated the tissues or the blood, find a fit soil for multiplication; and these may prove, by their mere numbers or by their effects, injurious or fatal to the whole body. Nothing can demonstrate this better than the experiment recently made by Orth and Wyssokowitsch (*Virchow's Archiv*, Bd. ciii., 1886), who found that staphylococcus could be injected into the blood of a rabbit without apparent injury; but, if before the injection, a slight mechanical injury was inflicted on the valves of the heart, typical endocarditis was at once produced.

In conclusion, I would desire to point out that this branch of inquiry is of quite a special character, and that it requires very considerable practice and entire devotion of time. Take my own case. I was most desirous to obtain cultures from various diseases of the eye attended with suppuration, to illustrate this lecture, but it is requisite, in the first instance, to have sterilised tubes and plates to grow the microbe. Though pretty well accustomed to delicate operations, very special precaution is required to introduce the matter gained without entrance of foreign bodies. Then an incubator is wanted; and, finally, there is the long and difficult examination with the microscope, with all its details of cutting, staining, mounting, and, not least, preserving in an accessible form. On these grounds, I hope that the Council of the College will see fit to institute, with part of Sir Erasmus Wilson's bequest, a laboratory devoted to this object, where one or two able demonstrators may continue the study of bacteriology, and prosecute, with all modern appliances, those researches, which are certain to prove of service in the diagnosis and treatment of disease.

PATHOLOGY OF ANEURYSM.

Read in the Section of Pathology at the Annual Meeting of the British Medical Association in Brighton.

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I UNDERSTAND it to be the wish of the managers of this meeting that the discussion which they have asked me to introduce shall turn rather on the practical aspect of the question than the theoretical—that is, shall bear on medical and surgical practice, rather than anatomical details. The time at our disposal does not allow of a complete treatise on the disease; and, therefore, all I shall here attempt will be a discussion of some of its main particulars, in connection with points of practice which are still unsettled. I shall speak of the influence of syphilis in causing aneurysm; of the relation between the aneurysmal tumour and the mouth of the sac; of the vital actions of the sac itself, and of some of the methods of spontaneous cure; using these pathological questions as illustrating the treatment of the disease (1) by medical means, (2) by the old operation, (3) by electrolysis, (4) by the introduction of foreign bodies, (5) by manipulation, (6) by Esmarch's bandage and by flexion, (7) by rapid pressure, and (8) by the distal ligature.

It is evident that I can only touch on all these matters very lightly, and that my office to-day is rather to start doubts than to solve them.

Stated generally, the cause of aneurysm may be said to be the weakening, in a given spot, of the resisting power of the wall of the artery to the blood-pressure. The artery is weakened by a wound or laceration of the external coat, or of the whole wall of the vessel, or (which I believe is common) by laceration of the internal coats, so that the blood insinuates itself beneath the external coat, and distends it; or an atheromatous patch deprives the artery of its elasticity in that

spot; or an ulcer penetrates the arterial wall completely¹ or incompletely; or the artery is weakened by inflammation of the parts which surround and support it; or increased strain is put upon it by corporeal exertion, or by cardiac irregularity; or these various causes are variously combined.

But it is evident that such general statements are of little use in practice. We are not yet fully informed as to the nature of the various degenerative processes to which arteries are liable. Two, however, are familiar to us—the atheromatous—which used to be regarded as a fatty degeneration, but which is now believed to be really inflammatory, though fatty changes speedily ensue,—and the syphilitic, or gummatous, which has been minutely studied in the arteries of the brain, and which, no doubt, affects other arteries also. No one doubts that the atheromatous degeneration is a constant cause of aneurysm; but the connection between aneurysm and syphilis is a more doubtful matter, and it is to this question that I shall first address myself.

The logical possibility—nay, even the great probability of such a connection—is indubitable. There is no question that the subjects of aneurysm have frequently had syphilis. Dr. Mahomed published statistics to prove that aneurysm is more common in syphilitic subjects than in others (*Path. Trans.*, vol. xviii, p. 347); and, however short of proof such statistics may be, we may admit that the fact is probable. But it does not show any real connection between the two pathological processes, nor did Dr. Mahomed adduce it for that purpose. In fact, he expressed in the same paper his conviction that there is not a tittle of evidence that the prevalence of aneurysm in syphilitic cases is due to a "syphilitic arteritis." Syphilitic subjects are usually persons broken down by hard living of all kinds, and have been exposed, beyond the average of other men, to the causes which produce diseases of the circulatory system.

In saying that it is still uncertain whether aneurysm is produced by a specific syphilitic arteritis, I do not wish to be understood as denying that a syphilitic affection of the arteries exists. Many cases have been put on record in which lesions exactly like the gummatous affections of other parts, have been found in the arteries of persons the subjects of other syphilitic diseases. This has been done, especially for arteries of the brain, by Heubner (*Die huetische Erkrankung der Hirnarterien*, Leipzig, 1874), and many cases are described with complete anatomical details by English pathologists, such as Clifford Allbutt (*St. George's Hosp. Reports*, iii, 60; *Path. Trans.*, xxiii, 16); Greenfield, Gowers, Buzzard, Davidson (*Ibid.* xxviii, pp. 272, 286, 295, 300), Sharkey (*Ibid.* xxxiv, 10), and many others. Constitutional syphilis seems to affect the arterial system, sometimes in the form of a thickening of the internal coat, with exudation in the neighbouring more external portions of the arterial wall, and narrowing or even complete obstruction of the tube, sometimes in the form of gummatous tumours of the external coat, or the sheath. Now it is obvious that a deposit, whether in the external or internal part of the wall of the vessel, may soften or break down, and so leave the vessel weakened at that spot, and prone to aneurysm. Admitting fully, however, the theoretical possibility, when we come to look to the records of cases, there seems little proof of the prevalence of such syphilitic ulceration of arteries. Thus, in Heubner's work, we have notes of fifty cases from his own and others' practice, in most of which the whole arterial system was examined after death. In only one case (No. 24) was there an aneurysm, and in one other (No. 18) ulceration and rupture of an artery. In both these cases, the artery affected was in the brain. In none was there any external aneurysm. There was indeed more or less extensive atheroma in several, but it is obvious that there is no reason why an atheromatous subject should not contract syphilis, or vice versa. The two processes, however,—the syphilitic, and the atheromatous degeneration of arteries,—are very clearly contrasted, and in many respects opposed to one another: mainly in these two particulars, that the syphilitic process is most common in the smaller vessels, especially the cerebral—the atheromatous in the largest arteries; and that the syphilitic leads usually to thickening of the arterial walls, contraction of the tube, and thrombosis, while the atheromatous produces weakening of the wall of the vessel, leading to aneurysm or rupture. There is, therefore, little support from pathological anatomy for the view that syphilis is a frequent cause of aneurysm; nor has the great practical objection ever been answered, that, if it were so,

aneurysm would be far more common in the female sex than it is. The question is an important one to our present purpose, since the assumed syphilitic nature of the disease has been used to explain the alleged virtue of the iodide of potassium in its cure. I would, therefore, just remind you how often these, like other affections, are classed as syphilitic when they occur in syphilitic persons, and again, how often the previous occurrence of syphilis is inferred from the existence of an affection which the observer assumes to be syphilitic.²

My own view of the matter is that the true syphilitic degeneration of arteries rarely leads to aneurysm, but rather to the obliteration of the small vessels which are its favourite seats. But I would not deny that there may be exceptional cases, in which the syphilitic deposit breaks down prematurely, and the arterial wall gives way, either totally, causing hemorrhage; or partially, leading to aneurysm.

The fact that aneurysm is more prevalent among the syphilitic than the non-syphilitic, if true, seems to me inconclusive. In this, as in all other medical matters, nothing is more misleading than the so-called "statistical" argument. The causes of medical facts are so complex, that it is hardly possible to eliminate all causes but one, in two opposed series of cases; yet this must be done before a reliable statistical comparison can be made.

I have not here the space, and perhaps it hardly falls within my appointed province, to discuss the alleged virtues of iodide of potassium in the cure of aneurysm. Without denying its success in the hands of others, I can only say that in my own hands, and in the other cases which I have had the opportunity of watching, it has proved futile. If it cures, it does so, I think, not by any specific influence on an assumed syphilitic deposit in the wall of the vessel, but by its influence on the general circulation. Nor have I ever been able to convince myself of the curative virtue of any drug. Complete rest and carefully regulated diet are almost always beneficial, and, in some exceptionally fortunate cases (such as Mr. Stanley's³) may produce a cure; and, as far as I can see, it is more reasonable to ascribe the cure in those cases which have recovered under the use of iodide of potassium, acetate of lead, or other drugs, to the accompanying rest and regimen than to the medicinal treatment.

Whatever may have been the pathological action (traumatic or spontaneous) which has weakened the wall of the artery, it yields in a portion or the whole of its circumference, and for a greater or less distance; and hence a difference arises between different forms of aneurysm, which has great practical significance. The typical form of those aneurysms which are produced by the giving way of a small portion of one side of the wall of the artery has been described, with his usual lucidity, by Mr. Syme, who, however, committed the error of speaking as if he believed that all aneurysms are of this form—an opinion which I cannot think that so great a surgeon could really have entertained, though his words imply it. "In every aneurysm, whether large or small, traumatic or spontaneous, the aperture of the artery is situated towards the centre of the tumour, so that a portion of the vessel, longer or shorter according to the size of the sac, is contained within its cavity, or rather embraced by its wall." (Syme, "Treatment of Axillary Aneurysm," *Medico-Chirurgical Transactions*, vol. xliii, p. 138.)

Many aneurysms are, no doubt, of what we may call "the gummate" form—standing off from the trunk of the vessel like a bud. On the other hand, many are of the cylindrical or fusiform variety, having been formed by the yielding of a more or less extensive tract of the whole artery. Many, again, are of a mixed form, having, as in the fusiform aneurysms, two openings in the sac, by which the artery enters and quits it; but these are not, as in the fusiform, at opposite ends of the tumour, but may be close together.

The practical importance of these apparently minute particulars

¹ I once met with a striking case of perforation of the aorta by a small ulcer. A friend of mine, a medical man in the prime of life, fell down in the street, and died in a very short time, with symptoms that led us to suspect the bursting of an aneurysm. He had had no previous illness. On post mortem examination, no aneurysm was found. The descending thoracic aorta showed a small perforation, which would just admit a probe. With the exception of a very small patch of atheroma, not far from this ulcer, the whole arterial system was quite healthy. He was not known ever to have had syphilis, had long been married, and was the father of healthy children.

² I will instance this by referring to two cases: one reported by Dr. Goodhart, in Vol. xxvi of the *Pathological Transactions*, as a case of "nummular arteritis." There were round raised patches on the inner surface of the aorta, apparently due to thickening of the internal coat, one of which had softened and formed an aneurysm. The patches no doubt bore some resemblance to one of the forms of syphilitic degeneration. There was the scar, as of an old bubo, in the groin; there was fibrous degeneration of the testes, and fibrous cicatricial bands in the trachea and bronchi. All this Dr. Goodhart believes to constitute distinct proof of previous syphilis, although the man denied ever having had the disease. Still Dr. Goodhart does not claim the case as an instance of syphilitic arteritis, but wisely leaves the question open. Many such cases, however, are hastily assumed as syphilitic. The second case is one published by Dr. Turner, in Vol. xxvii of the *Pathological Transactions*. Here a woman died from ulceration of the aorta into the pericardium, probably proceeding from the softening of such a patch as existed in the last case. The disease is classed as syphilitic, because the patient was a prostitute; yet there was no proof of her having had syphilis, and no syphilitic lesion existed in any other part of the body. Now, without denying the probability of this being a syphilitic lesion, I submit that it is in no way proved to have been so, and that there is no reason to deny that similar arterial lesions may take place in persons entirely free from all taint of syphilis.

³ A drawing of this preparation was exhibited.

would be at once apparent to any surgeon who should often repeat Mr. Syme's adventurous operations for the cure of aneurysms in the axilla, neck, and abdomen. In all these situations (more especially the neck) it might be a question of immediate death or life to the patient, whether there was only one opening which the surgeon's finger could command, or whether there was a second in some possibly remote, and certainly unknown, position, down which the blood would pour (for in all parts of the body, and in the neck especially, the reflux stream is very rapidly formed), obscuring all the field of operation, and very probably rendering the ligature of the artery impracticable.

Let me illustrate these different relations between the vessel and the aneurysm by these three drawings, taken from actual specimens. This diagram, taken from Scarpa, shows the condition described by Syme. There is a single opening, a portion of the artery is embraced by the wall of the aneurysm, and the old operation might have been performed; though, of course, not without the most formidable danger. In this, on the contrary, taken from an axillary aneurysm, preserved in the Museum of Guy's Hospital, there is a large sausage-shaped tumour, and the artery opens into and out of it by two openings situated several inches from each other; besides which, large branches open out of the sac, and the tumour is embraced on all sides by the nerves of the brachial plexus. In the third drawing which I shall have to refer to again, a small popliteal aneurysm is shown, with the artery opening into and out of it. If the disease had gone on longer, and the aneurysm increased to a large size, these two openings might have been separated by the whole extent of the tumour, as in the last specimen, or the sac might have grown upwards or downwards along the vessel, leaving the two openings separated by either a large or small distance.

But, in speaking of Mr. Syme's cases, we should recollect that some of them were not really aneurysms, in the strict sense, but instances of subcutaneous laceration of arteries, there being no sac. These cases are rather analogous to wounds of arteries, and are amenable to the same treatment.

And this leads me to speak of the importance of the sac in the pathology and cure of aneurysm. We are, I think, too apt to reason about aneurysm as if the sac were a dead india-rubber bag, acted on by hydraulic pressure, instead of a living tissue, whose vital actions must be taken account of, in any complete theory of the growth or cure of aneurysm. The persistent fluidity of the blood in healthy vessels is due, no doubt, to the vital properties of their walls. The constant presence of layers of coagulum in portions of aneurysmal sacs can hardly be due to other than the converse of such properties. The rapidity with which under favourable circumstances aneurysmal tumours shrink and sometimes almost disappear is quite inexplicable on mechanical principles, and must be due, in great part, to the vital actions of the tissues forming the sac. The sudden growth of aneurysms in one direction, and often when consolidation is going on rapidly in other parts of the tumour, is equally a vital phenomenon. And all this shows that our treatment, to have the best prospect of success, must be directed not to the contents only of the aneurysm, but must be such as to place the sac in the most favourable conditions. The treatment introduced by my late friend, Mr. Moore—viz., the introduction of foreign bodies has the inevitable defect that it is in no way directed to the sac of the aneurysm; inevitable, I say, because the treatment was only intended for, and should only be used in cases where more promising measures are inapplicable. In many cases it even acts injuriously on the sac, producing inflammation and softening, which lead either to rupture or to extension of the tumour. The same may be said of the electrolytic treatment. It is often injurious to the sac and to the tissues around it, and therefore has often an injurious and sometimes a fatal effect on the aneurysm. Yet there is no doubt that both electrolysis and the introduction of foreign bodies have, in fortunate cases, been followed by considerable benefit. In one famous case—that of an abdominal aneurysm treated by the introduction of copper-wire by Professor Loreta, of Bologna (BRITISH MEDICAL JOURNAL, April 11th, 1886), this improvement was so considerable as to produce temporary cessation of all the symptoms and an appearance of radical cure.

I will here translate the account which Professor Loreta gave me of the termination of this case in a letter dated May 3rd, 1886:—"His death happened ninety-two days after the operation, he being at the time in an excellent state of health and the tumour hardly perceptible to the touch. *Post mortem* examination showed that his unexpected death was caused by rupture of the aorta immediately above the tumour, just where the remains of the aneurysmal sac joined at an angle with the anterior wall of the aorta. The sac was only the size of a walnut, and perfectly consolidated by organised coagula; the copper-wire was unaltered and rolled up into a ball inside the sac itself.

In fact, everything showed that the effects produced were actually those sought by the operation." Professor Loreta adds, as a conjecture, that it is possible that the compression and other changes following on the consolidation of blood in the tumour might have interfered with the circulation in the wall of the artery, and thus produced the rupture in its coat.

Another case was lately published, under the care of Dr. Cayley and Mr. Hulke (*Medico-Chirurgical Transactions*, vol. lxi., p. 267), in which considerable temporary benefit was obtained in a case of aortic aneurysm by the insertion of wire; and Mr. Bryant's case of popliteal aneurysm is well known, where a considerable amount of consolidation followed the insertion of horse hair (Bryant's *Practice of Surgery*, 4th ed., vol. i., p. 517). And we may easily admit that either of these methods might indirectly, or accidentally, prove curative by the production of a clot which might obstruct the mouth of the aneurysm and imitate that cure by impaction, which I believe to be not very uncommon, and which was deliberately imitated by Sir W. Ferguson in his very ingenious, but very dangerous, proposal of manipulation. This same form of cure is also, I believe, often produced by the action of Esmarch's bandage, and in all forms of direct pressure, as well as the "rapid" method of indirect pressure.

Now in this cure by impaction of the clot, the sac plays a prominent part. Released from the constant distending and disturbing force of the circulation, it rapidly contracts on the semi-solid contents of the aneurysm, and furnishes the means and the agents for the absorption of its fluids, so that the tumour rapidly shrinks and hardens. Whenever the disappearance of the *bruit* proves that the mouth of the sac is obliterated we may expect this to occur, and it appears to me that the rapidity of the action varies with the integrity and vigour of the sac. All the methods of natural cure afford valuable indications for surgical treatment, but this method by impaction of clot, is of especial interest from the analogies which it presents with some of the most recently-introduced methods of treatment, manipulation, Esmarch's bandage, flexion and rapid pressure. In manipulation, the cure is sought almost wholly by the impaction of clot. The surgeon attempts to empty the tumour of its fluid contents by pressure and to detach some of the clots by rubbing the sides of the sac against each other. In one case, at any rate, where Sir W. Ferguson manipulated an aneurysm at the root of the neck, the symptoms produced were identical with those which marked the impaction of clot in the carotid in Dr. Bence Jones's case to be presently mentioned, and they were no doubt produced by the same cause. Again, in the use of Esmarch's bandage, not only the dissection of Mr. Wagstaffe's case just referred to, but also the history of other successful cases seem to me to prove that impaction of clot plays a large part in the process; and I doubt not that the same thing often, if not always, occurs in the cure by flexion of the limb. In successful cases, also, of rapid pressure, the pulsation and the *bruit* usually go on after the pressure is withdrawn, and then the *bruit* stops, while the contents of the tumour still remain semi-fluid, and even some pulsation may be detected. The movement in the contents of the sac then ceases, as the impaction becomes complete, and soon the rapid shrinking of the tumour testifies to the completeness of the cure. In other cases the *bruit*, after a temporary absence, recurs, and the aneurysm is soon pulsating as strongly, and its contents become as completely fluid, as before the application of pressure.

All these methods of treatment partake, therefore, of the dangers involved in the spontaneous cure by impaction, while they have also dangers of their own, manipulation, Esmarch's bandage, and flexion, involving the risk of rupturing or contusing the sac; while rapid pressure causes in some cases injury to the viscera or other parts by the compressor, and, in others, involves the danger of prolonged anaesthesia.

Too little importance is, I think, usually attributed to the existence and character of the aneurysmal *bruit*. Its absence is of evil augury for the curability of the case, as proving that there is no proper mouth to the aneurysmal sac. Let me instance this in the case (reported in the ninth vol. of the *Clinical Transactions*) of a very small popliteal aneurysm, or aneurysmal dilatation, destitute of *bruit*, occurring in the person of a man in the prime of life, aged 34, and apparently in good health, but whose unfortunate end seemed to show that he was much addicted to drink. Though the tumour was so very small, and the patient tolerant of pressure, no progress towards cure was made by more than a month's patient treatment, and so the artery was tied.⁵ One can hardly doubt that a sacculated aneurysm of so small a size would have easily yielded to flexion or pressure.

⁴ See the illustration to Mr. Wagstaffe's paper in *Pathological Transactions*, xxix., 72, showing soft coagulum in the sac undergoing lamination, and obstruction of the artery in the neighbourhood of the tumour. The aneurysm had been cured about three months.

⁵ A diagram of this case was exhibited.

We see how rarely external aneurysms are devoid of *bruit*, and, on the contrary, how common this is in thoracic aneurysm: and the reason is obvious, namely, that the former are, as a rule, sacculated and curable, the others often destitute of any distinct orifice, and practically incurable.⁶

Then the way in which the *bruit* radiates from a given spot, and the presence or absence of a thrill due to roughness or coagula on its sides, are important practical points, which should not be left out of view in the study of any case with a view to treatment.

The nature and direction of the growth of an aneurysm are often matters of much importance in choosing a means for stopping such extension when it threatens to become dangerous. This is clearly shown in cases where innominate or aortic aneurysms are growing towards the windpipe, and where that growth has been stopped by the distal ligation of the carotid. Such operations are often successful in preserving life, even though the aneurysm remains uncured. I would refer to a case (reported in *Clinical Transactions*, ix, 114) of a young woman, then unmarried, whose left carotid artery I tied for an aortic aneurysm. I heard from her in July, 1884, nearly nine years after the operation, and she was then in fair health, married, and attending to her household duties. I wrote again to her former address a few weeks ago, and received no reply, so cannot say whether she is still alive. The aneurysm had never been cured, but its growth had been suspended during this long period. Nor is it difficult, I think, to see how these operations prove beneficial. The aneurysm grows in the given direction because the "carotid" portion of the sac, either through weakness or through organic softening, the result of inflammation, yields to the force of the carotid circulation. The ligation of the artery diverts the blood into the anastomosing branches, derived either from the subclavian of the same side, or from the opposite side of the body, and thus the pressure is taken off from the weak portion of the sac, which may then recover its contractile power as coagulation commences in that portion of the tumour. I have tried to show that this coagulation may be powerfully assisted by the coagulation of blood in the tied artery, extending into the mouth of the sac, but it does not seem that such extension of clot from the seat of ligation is a necessary condition of cure.

Let me illustrate my meaning by a reference to the accompanying drawings—some of the series which I had made for a course of lectures on aneurysm delivered many years ago at the College of Surgeons. They show three preparations; the first is from a case of innominate aneurysm, reported by Mr. Heath (*Path. Trans.*, ix, 95), in which the subclavian portion of the sac was cured by the impaction of clot in the mouth of the artery as it leaves the tumour, but the carotid portion went on growing, and burst into the trachea; the second are two views of a preparation taken from a patient of Dr. Bence Jones in St. George's Hospital, whose case is reported in the same volume of the *Path. Trans.* Here (as the front view shows) the carotid artery has been obstructed by clot, causing the obliteration of the whole vessel, exactly as after a long-previous ligation. The impaction of clot in the carotid artery occurred about five years previous to his death, which was caused by phthisis. It was attended by urgent head-symptoms and complete loss of consciousness. This has been followed by the complete cure of the whole of the carotid portion of the sac; and this portion is so much the larger, that it appeared at first sight as if the whole tumour was obliterated; and it is so reported in the *Path. Trans.* But on making a section at the back of the tumour (as represented in the second view) I found that the subclavian portion of the sac, which was very small, is unobliterated, and that the stream of blood passed directly up this portion of the sac into the subclavian artery. The cure, therefore, though practically complete, was anatomically imperfect. The third shows precisely the same state of parts in a case where the carotid artery has been obliterated by the ligation. The patient was under the care of Dr. Wright, of Montreal, and the artery was tied eighty-seven days before death. The patient died from cerebral softening, the result of the operation; but its effect on the aneurysm was to produce a "practical cure," exactly like, in every particular, to the effect of the impaction of clot in the carotid artery in the former case.

These three cases, taken together, form the neatest demonstration that I am acquainted with of the action of the distal ligation; the first shows a state of things in which distal ligation of the carotid might possibly have been followed by complete cure; while the second shows that, even without complete cure, the growth of the aneurysm

may be stopped, and the patient restored to health by the spontaneous obliteration of the carotid as it leaves the sac; and the third is an interesting example of the production of precisely the same state of parts by operation on the carotid.

If I am right in this explanation of the action of the distal ligation, it would follow that the complete obliteration of the tumour can only be anticipated when the aneurysm is situated on a single artery without branches, as would be the case in an aneurysm affecting the carotid artery alone; but that in aortic and innominate aneurysms only portions of the sac can thus be consolidated. This, however, may often be the means of preserving the patient from immediate death.

There are many cases, especially of aortic aneurysm, where the growth of portions of the sac has threatened to prove fatal, and where such portions of the tumour have been successfully dealt with by the introduction of foreign bodies, or by electrolysis—that is to say, the operation has succeeded in producing consolidation in that portion of the tumour, and the patient has been rescued from the immediate danger; and it is, I think, more in these partial proceedings than in attempts at complete cure that the value of electrolysis and the introduction of foreign bodies is shown.

I do not think that I ought to occupy your time further. The observations I have made are, no doubt, disjointed and unsystematic; but they may, I hope, furnish material for discussion to the many able pathologists and surgeons attending the meeting.

Mr. BARWELL said that the excellent paper just read by Mr. Holmes went over a very wide and varied ground. He would only touch upon one of the subjects which he had broached, namely, the absence of any dependence of aneurysm on syphilis. He had had very large opportunities, which he had constantly seized, of examining aneurysms and diseased arteries; the result, omitting details, is that he had not, in a single case, found that large vessels were affected with syphilitic manifestations at all comparable with the undoubted syphilitic changes that were found in small arteries, more especially in the small branches of the internal carotids. Nor must we accept the dicta of certain morbid anatomists who assumed that a subject marked with scars on the genitals and groins was syphilitic; such scars were very rarely or never due to syphilis, but to chancre; and, in collating the results of observations, a large deduction would have to be made on account of the above very common error.

Mr. SYMONDS said that the only point to which he wished to refer was that mentioned by Mr. Holmes as a cause of aneurysm, namely, softening of the vessel from external inflammation. He had recently operated upon a case of aneurysm occurring in a stump, which was communicated to the Pathological Society. Here there had been suppuration in the stump, and to the softening of the vessel he attributed the formation of the sac. This case he looked upon as confirming Mr. Holmes's suggestion, that in all cases of aneurysm forming in stumps the vessel was diseased. He would also suggest that the rupture of such an aneurysm might more frequently be the cause of secondary hæmorrhage than was at present allowed. If this were admitted, the hæmorrhage in phthisis, known to occur from ulceration into a vessel, or from a ruptured aneurysm, was brought into closer relation with secondary hæmorrhage.

Dr. DRESCHFELD made some observations on the obscurity of the etiology of aneurysm. He agreed with Mr. Holmes that syphilitic endarteritis was not the cause, and drew attention to the amount of pressure an artery affected with atheroma could bear without breaking. As to treatment, one had to be very careful not to draw conclusions from one or two cases. The introduction of wire into the aneurysmal sac was likely to give better results than simple electrolysis. In a case under the care of Dr. Simpson, of Manchester, electrolysis was tried, and, after four or five applications, in the course of three years, no marked beneficial results were obtained; and the *post-mortem* examination showed that the patient had two aneurysms of the aorta, of which one, which had not been treated, was cured spontaneously, while the one which had been treated by electrolysis had showed but a very thin layer of fibrin. Dr. Dreschfeld also spoke of the injection of fibrin ferment into the aneurysmal sac. This treatment had been tried in one case, but unsuccessfully.

Mr. HOLMES, in reference to the question of diagnosis, said he had had a case of abdominal aneurysm, under his own care, in which a man came into the hospital with a fixed pain in the back and stiffness of the vertebrae, but no perceptible tumour. Soon afterwards a swelling appeared, and the man was carefully examined, both by auscultation and palpation, and neither *bruit* nor pulsation were detected. Death soon afterwards occurred from the bursting of the tumour, which was then found to be aneurysmal. In another case, under a colleague, the

⁶ The drawing first referred to is an interesting example of the curability of a very large aortic aneurysm when sacculated, and with a comparatively small orifice. It is from Mr. Stanley's celebrated case of a publican, in whom this very large aneurysm perforating the chest-walls was cured by rest and abstinence.

case was so confidently diagnosed as a psoas abscess, that it was shown to the students in discussing the treatment of that disease. Mr. Holmes thought these cases in point, as showing the occasional (though doubtless rare) absence of the usual symptoms of aneurysm of the abdominal aorta.

OBSURE DISEASES OF THE SPINAL COLUMN.

Read in the Section of Surgery at the Annual Meeting of the British Medical Association held in Brighton.

By NOBLE SMITH, F.R.C.S. Ed.,
Surgeon to the All Saints' Children's Hospital.

OBSURE diseases of the spinal column may exist as cancer, hydatids, syphilis or absorption from the pressure of an aneurysm, but the disease which most frequently occurs is caries; and I propose to limit my remarks on the present occasion to that affection.

The first object of my paper is to show that it is not only in the early stages that it is difficult to diagnose caries of the spine, but that the disease may sometimes progress to a very advanced stage of destruction of the spine; and that a patient may even die from its effects without its nature having been recognised.

A very deceptive peculiarity of some cases is the kind of pain experienced, or sometimes the entire absence thereof. I have met with several cases where pain in the back had been attributed to lumbago, continuing for several years (a suspicious fact). Cases have been sent me by gynaecologists to whom the patients have applied, believing that their troubles proceeded from some uterine complaint.

Case of March 6th, 1884, aged 5. Disease seen at the age of 2, and has since been increasing, but there has been no pain whatever.

Then follow several cases in which the pain was felt chiefly or entirely in the back, and was severe and nearly constant. Others in which the pain was only produced by stooping, or moving the legs, as in walking upstairs.

Case of November 20th, where the angular deformity in the dorsal region was very severe, and had been increasing for years, but there had never been any pain.

Case of December 2nd. Also a very severe case, aged 10. Hip-joint disease at the age of 3, coming on four months after a severe fall; at the age of 8, another fall occurred, followed by projection of vertebra in the upper dorsal and lowest cervical regions; much deformity; abscess in side of the neck, and paraplegia; but there had never been any pain.

These facts seem to me to teach the importance of extreme care in making a diagnosis.

Absence of pain, and, in fact, of all the symptoms usually described in books, characterises the history of some cases, the *post mortem* specimens of which are to be found in museums. In the Museum of the Royal College of Surgeons, No. 2,064 A (old number), (see Fig. 1), is the upper part of the spine of the late Dean Buckland,

Fig. 1.

of Westminster, who died in 1856, aged 52. The preparation consists of "The five upper cervical vertebrae (only the atlas and axis are here shown), with a portion of the occipital bone affected at several points with carious ulceration. The right transverse process, and both upper and lower articular surfaces of the same side of the atlas, are entirely destroyed. The corresponding condyle of the occipital bone is also diseased, and the articular surface of the axis, the right transverse process of the third vertebra, and the left occipito-atlantoid articulation." This description is taken from the catalogue, which further

records that "no other symptoms manifested themselves during life but those attributed to melancholia."

In St. George's Hospital Museum, 2A or V, 156 (see Fig. 2), is a

Fig. 2.

specimen, in which: "The lateral masses of the atlas," I quote from the Catalogue, "are extensively destroyed, and the tubercles for the attachment of the transverse ligament quite gone. The superior articular processes of the axis are greatly, the left almost entirely, worn away. The odontoid process is reduced to half its natural size. The posterior ligament remains intact, but the transverse and check ligaments have been completely destroyed."

From a boy, aged 8. The report states: "This case is of interest as showing how large an amount of disease of the atlas and axis may exist without giving rise to any of the ordinary or characteristic symptoms of disease of the cervical spine. The possibility of the existence of such disease was not overlooked; but, on the contrary, was constantly," the writer observes, "before my mind, and led to repeated and most careful investigations, with a view to its discovery; but these failed entirely to elicit any signs of its presence."

"There was no pain on rotating, or nodding or pressing the head; no difficulty in raising it; none of the characteristic fear of moving the head; no thickening over the bones; no tenderness or swelling behind the pharynx; in fact, until the end of the boy's final illness, nothing but wry-neck." "I need hardly say," proceeds the writer, "that, had I been aware of this, I should not have allowed him to move his head nor to leave the recumbent posture."

We ought, perhaps, to learn a lesson from this case; and to consider that, although the symptoms were so unlike what we have been taught to expect, yet the fact that they were soon relieved by fixation and recumbency, and rapidly recurred when the patient began to move about again, were then relieved a second time by recumbency in a fixed position, after six weeks of which the patient was seen with "the head held straight but stiffly, after the manner" (as was said) "of one with cervical spine disease," ought to have been considered indicatory of the nature of the disease. It was not, however, so considered, and the child was allowed to get about.

Another case in St. George's Hospital Museum is that numbered 2 B. There exists caries "of the bodies of the upper four cervical vertebrae and intervertebral cartilages, communicating with an ulcerated opening at the back part of the pharynx. The membranes of the spinal cord were in this situation united to each other, and to the posterior surfaces of the vertebrae. The upper part of the spinal cord was softer than natural. The symptoms produced by the disease were so slight that the ulcer of the pharynx was not, previous to the patient's death, known to have any communication with the bones of the spine. The patient died suddenly."

In the Royal College of Surgeons Museum, No. 2093, is the specimen of a very remarkable case in a child about 6 years of age, in whom "the symptoms were supposed to be those of hydrocephalus. A swelling occurred at the side of the neck. The child steadied its own head with its hands, and moved very cautiously. The symptoms gradually ceased, and the child regained health, but died, at the age of 12, from lumbar caries. The *post mortem* examination showed the great displacement of the upper two vertebrae from disease; there had been no hydrocephalus." (Fig. 3.)

Here was one of the characteristic symptoms of diseased vertebrae, but, probably because of the absence of other symptoms, the nature of the disease was overlooked.