AMPUTATION IN SENILE GANGRENE.

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WITH reference to amputation in senile gangrene, nearly all authorities agree that it is not wise to undertake the operation; it therefore requires some courage and some convictions to justify any surgeon in advocating a course which is in opposition to generally received opinion. The case which I shall presently narrate, and in which I amputated with most gratifying success, with other cases I have seen, must afford my justification for the line of treatment I consider advisable under certain circumstances in cases of senile gangrene. It is true that, from time to time, surgeons have recommended amputation, and notably the late Mr. James of Exeter; but, even when they have done so, it does not appear that any very precise directions have been given for the guidance of those who may wish to follow such recommendation. For my own part, I should not for one moment wish it to be understood that an indiscriminate amputation is to be adopted in all cases of senile gangrene; that, given any case of spontaneous gangrene occurring in old people, therefore or necessarily the treatment is to be amputation. On the contrary, I believe the greatest discrimination must be exercised in selecting the proper case for amputation. I will presently endeavour to state under what circumstances I consider amputation in senile gangrene to be necessary; but I would here remark that I believe the antiseptic method of treating amputations in these old people is just sufficient, in consequence of preventing suppuration and a prolonged call upon their enfeebled nutritive powers, to turn the scale in favour of amputation. Two remarkable instances of this have recently come under my own observation. The history of one of these cases is as follows.

W. G., aged 62, a farm-labourer, always living in the country, was admitted into the Bristol General Hospital under my care on November 19th, 1881. Though not strictly aged, yet he was old—old, that is, in his appearance and the signs of degeneration, especially of his arterial system, as might be seen and felt in his superficial arteries. His heart was free from valvular disease, but feeble in action. He was thin and somewhat shrunken, but had always been temperate; and his kidneys were free from disease. He had suffered a good deal from exposure during the previous severe winter. About three weeks before admission, he had noticed a slight dark spot on the fourth toe of the right foot; soon his little toe of the same foot became similarly affected. Two toes of his left foot also showed signs of failing circulation in them. On admission, the two smaller toes of the right foot were distinctly gangrenous, with no attempt at demarcation. The foot also was swollen and red. The toes themselves were black, dry, and shrivelled. He suffered considerable pain. Both feet and legs were enveloped in cotton-wool, and elevated on pillows. He was put on a generous diet, with four ounces of brandy; iron and quinine, with cod-liver oil; and opium to relieve the pain. The pulse was 80, regular. The radial arteries were atheromatous and tortuous. No pulsation could be felt in either anterior or posterior tibial, nor in the popliteal artery, though pulsation could be traced in the femoral to the bottom of Hunter's canal.

November 22nd. A line was beginning to form on the fourth toe, but also a fresh one on the third toe. The darkness of the left foot had almost disappeared.

December 9th. The patient had severe diarrhoea, with febrile disturbance, a dry tongue, and a temperature varying from 103° in the evening to 99° in the morning. Pulse from 112 to 96, and irregular. The gangrene had spread somewhat up the outer side of the foot. The parts were dressed with iodoform and boracic lint.

December 20th. The toes were distinctly separated, and the bone was just nipped through. The gangrene seemed to have halted, as it had done once or twice before, but soon spread again with renewed activity; and from this point it spread vigorously, soon involving the outer side of the foot and dorsum, going up the leg, and accompanied by redness, oedema, and marked inflammatory conditions locally; whilst the smell was most offensive. This was controlled, though not entirely subdued, by iodoform. Things went on from bad to worse until, on January 9th, when I had not seen him for two or three days, I found the gangrene had extended to three inches above his ankle. He was extremely feeble, quite unconscious, with a low muttering delirium. He could not be roused, and apparently he was moribund.

However, as he could swallow, I ordered his brandy to be increased, and gave him sulphuric ether. I discussed the question of amputation; but it seemed so hopeless that I did not do it. Next day, he was not worse; and, feeling sure that he was being poisoned by the offensive products of his own gangrenous limb, and that he could not live more than a few hours if left to himself, I determined to give him what appeared to be the forlorn hope of amputation. Ether was administered as an anæsthetic, and I removed his thigh by the circular method at the lower third, with antiseptic precautions. The femoral artery was patent at the point of section, and was secured by catgut ligature. He had twelve ounces of brandy in the next twelve hours. In the evening, his pulse was 75, and his temperature 96.5°. Next day (January 11th), his temperature had fallen as low as 95°, but at 12 A.M. it registered 96°. I need not detail his case further. On the 16th, six days after the operation, all the stitches were removed. The stump had healed; but there was a small dark patch, as large as the little finger-nail, which I believe to have been caused by the thinness of flap at this point. This had existed since the operation. However, it remained aseptic throughout, and gradually separated without extending. This fact is worth mentioning, as showing the behaviour of a small slough under antiseptic precautions. He is now practically well, though I did not allow him to get up before the 27th, seventeen days after the operation. It was singular to notice how quickly (after his recovery from the shock of the operation) his delirium and other symptoms of septic absorption left him. His delirium disappeared on the second day, although for days before he had been drowsy, delirious, and even comatose, at times.

Such is the history of the case. I feel that his life was literally saved by the operation; he could not possibly have lived for twenty-four hours unless something were done for him by amputation. He was dying of septic absorption—poisoned by his own decomposing tissues. I confess I looked upon the operation as a somewhat forlorn one; but, taking the view I did of his symptoms, and that he must inevitably die if left to himself, I determined to amputate, feeling sure that gangrene would not recur in the stump, as I could feel the femoral artery patent at the point of operation; and that, if he survived the shock of the operation, he might recover. But there was just the point, that he might have already received such a dose of septic material that he might not survive this. There can be no question that, even when the circulation of the blood in a gangrenous limb is completely stopped, and when clots have already formed in both arteries and veins, the sphacelated part may act as a source of infection. Kussmaul's experiments show that absorption of substances into a gangrenous part takes place. He injected iodide of potassium under the skin of a gangrenous limb, and found evidence of it in the urine four hours afterwards. Charcot, than whom none can have had a larger experience of diseases of the aged, says: "It cannot be doubted that putrid substances from sphacelated parts may themselves penetrate into the circulating current." He has frequently observed this in cases of spontaneous gangrene, the result of atheromatous obliteration of the chief arterial trunks.

On one other occasion, I removed the thigh at the lower third in a patient aged 68, for spreading senile gangrene. He lived a month, but broke down from bed-sores at the end of that time, with signs of feeble reparative processes in the flaps; and eventually died of pyæmia. In this case, the femoral was blocked at the seat of ligature. I have now no doubt in my own mind that, had I treated this patient antiseptically, and taken all the precautions that I did in my last case, I should have pulled him through also.

There is now in the hospital a remarkable case, which my colleague Mr. Lansdown has kindly permitted me to mention, in which he amputated just below the knee in an old broken-down albuminuric man, aged 72, for spreading senile gangrene, and where the stump has already healed.

These cases alone would be sufficient to show that the powers of repair even in the very aged are, when carefully husbanded, sufficient to heal even large amputation-wounds. This point is clear. I feel now that I delayed amputation too long in my last case. I say this, even though the result was successful. In similar cases, I should in the future amputate much earlier. Even one life saved, as this man's was, is a distinct triumph of our art. I would thus formulate what I have to say with reference to amputation in senile gangrene.

1. I would not amputate in those cases where the patient's strength was fairly good, where there was a fair prospect that a line of demarcation would be formed, where he was not suffering great pain, or where the pain was readily controlled by small doses of opium, and where symptoms of septic absorption were absent.

2. I would advise amputation in all those cases where the patient was not extremely aged—i.e., over seventy-five or seventy-six—in which the pain was very severe, the gangrene rapidly spreading, and

in which marked symptoms of putrid poisoning were manifesting themselves; and I would amputate irrespectively of the patency or otherwise of the main artery at the spot selected for amputation—preferring, of course, patency.

3. In cases of amputation under such conditions as I have mentioned, I would amputate above the knee for gangrene of the leg, above the elbow for gangrene of the hand or forearm. Even when the main artery is blocked, the collateral circulation is generally sufficient to carry on the nutrition of a comparatively short stump. This is my reason for a comparatively high amputation. The mere fact of the possibility of rapid healing of a large stump in even very old persons is a sufficiently well established fact in surgery to need comment. The point I would further insist on is that, with antiseptic precautions, there is usually a minimum stress laid upon the powers of repair, which is especially useful in dealing with such cases as those we are now considering. I may further add, that my colleague Mr. Coe has long advocated views similar to those put forward in this paper, and has had several successful cases.

ABSTRACT OF LECTURES

ON THE

ANATOMY, PHYSIOLOGY, AND ZOOLOGY OF THE EDENTATA.

Delivered at the Royal College of Surgeons of England.

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LECTURE IX.

THE more important results which follow from the facts collected together, in the foregoing lectures, may be thus stated.

The existing Edentates readily group themselves into five distinct families, of the limits of which there is no reasonable doubt. These are: 1. The *Bradypodidae*, containing two genera, *Bradypus* and *Choloepus*; 2. The *Myrmecophagidae*, containing three distinct modifications worthy of generic rank—*Myrmecophaga*, *Tamandua*, and *Cyclothorus*; 3. The *Dasypodidae*, which may be divided into two sections, one containing the genus *Tatusia*, which, in the presence of milk-teeth, the structure of the fore feet, as well as in many characters of the visceral anatomy, stands apart from all the other Armadillos; and another, including the genera *Dasybus*, *Xenurus*, *Prionodon*, *Tolypterus*, and *Chlamydophorus*, which are clearly all modifications of a common type, although the latter shows such a striking difference in the character of its dermal armature that it might make a section apart, if its internal structure were not so closely similar to that of *Dasybus*; 4. The *Manidae*, containing about seven species, the slight modifications of which are scarcely worthy of being considered generic; 5. The *Orycteropodidae*, with one genus containing two closely allied local forms and species. The three first-named families are inhabitants of the New, the last two of the Old World. The families of which all the members are extinct, are the *Megatheriidae* and *Glyptodontidae*, both American and post-tertiary; the one related to the *Bradypodidae*, and the other to the *Dasypodidae*. The Tertiary forms are less known; but those of the New World may be provisionally grouped under Marsh's name of *Moropodidae*, and those of the Old World as *Macrotheriidae*.

As to the mutual relationship of these families, it has been customary with all recent zoologists to group them into two divisions, often called suborders: the *Phyllophaga*, *Phytophaga*, or *Tardigrada*, including the *Bradypodidae* and *Megatheriidae*; and the *Entomophaga* or *Vermilingua*, containing all the others, unless, as in some systems, *Orycteropus* be placed apart as forming a distinct section.

Whether these distinct suborders be adopted, or the families merely arranged in their supposed relationship, the Old World Anteaters, or *Manidae*, are invariably closely associated with the New-World Anteaters or the *Myrmecophagidae*, and the latter are widely separated from the Sloths.

This being the view universally accepted at the present time, it is desirable to ascertain whether it is really based on important structural relations, or only upon what may be called superficial or adaptive modifications.

The bonds which unite the *Manidae* to the *Myrmecophagidae* are mainly to be found in the structure of the mouth, especially the extensile character of the tongue, the great development of the submaxillary glands,

and the absence of teeth. These characters are exactly analogous to those found in the *Echidna* among Monotremes, the Woodpeckers among Birds, and the Chameleon among Reptiles. The fact probably is that, in countries where termites and similar insects flourish, various distinct forms of vertebrates have become modified in special relation to this abundance of nutritious food, which could only be made available by a peculiar structure of the alimentary organs.

To commence with the skeleton, one of the most striking characters by which the *Myrmecophagidae* differ from ordinary mammals, is the presence on the posterior dorsal and the lumbar vertebræ of accessory articulating surfaces, below the true zygapophyses common to all mammals, and situated upon a process which projects backwards from the side of the arch, and interlocks into the succeeding vertebra in a tenon-and-mortice fashion. These articulations are found equally well developed in the *Megatheriidae* and in the *Dasypodidae*. The existence of similar articulations in the genus *Bradypus*, even in a rudimentary form, is extremely significative. It may be said that they almost prove that the Sloths are descended from animals in which they existed in a fully developed form. On the other hand, like as in some respects the vertebral column of *Manis* is to that of *Myrmecophaga*, not a trace of either of these articulations or of the processes on which they are situated is to be found in the former. In *Orycteropus* also, they are entirely absent. On this ground alone, we might be justified in assuming that the Old-World Edentates are not closely related to the American forms.

Nothing can be more different than the characters of the sternum of *Myrmecophaga* and of *Manis*. In the former, the numerous mesosternal segments are small, laterally compressed, and articulated with each other and with the strongly ossified sternal ribs by synovial joints. In the *Manis*, the sternum is broad and flat, and the sternal ribs only partly ossified, and connected with it in the normal manner. In these characters, the *Bradypodidae*, *Megatheriidae*, and *Dasypodidae* agree with the Anteaters, and *Orycteropus* is more nearly related to *Manis*.

The gigantic post-tertiary Edentates of the New World, *Megatherium* and its allies, throw much light upon the close affinity of the Sloths and true Anteaters. By common consent, they have been placed among the former, when the order is divided into two divisions, and are spoken of as "Ground Sloths"; yet, in many important characters, perhaps in all those not relating to the functions of prehension and mastication of food, they are quite as near, if not nearer, to the Anteaters. They may truly be regarded as intercalary types, bridging over the gulf which now exists between them. The teeth are certainly those of the Sloths, even to the actual number in most genera; but the diminution of that number in *Cylodon* leads towards their total suppression in *Myrmecophaga*. In the lengthening of the anterior part of the skull in *Megatherium*, but more strongly marked in *Scelidotherium*, the commencement of the *Myrmecophaga* type is clearly seen; and that they had tongues, longer and more protractile than those of existing Sloths (perhaps even prehensile, as Professor Owen suggests), is very probable. The vertebral column, ribs, sternum, and tail is far more Myrmecophagine than Bradypodine. In the scapula, they possess a character which is shared both by Sloths and Anteaters, but by no other mammal; the coracoid bone and the coracoid border of the scapula join over the coraco-scapular notch, converting it into a foramen. The recent discovery of clavicles in a rudimentary state in all three species of *Myrmecophaga* adds another common character to the group, though perhaps not one of first class importance. It must, however, be noted that in no species of *Manis* has any trace of a clavicle been found. The flattening of the femur, and development of a linear ridge along its external border, is common and peculiar to the Sloths, Anteaters, and Megatheres. The special characters of the manus in these three families are all derivations from a common type; but in this portion of their organisation the Megatherioids show their relationship with the Anteaters much more than with the Sloths. In the mode of setting the foot to the ground, and the absence of claws upon one or more of the outer digits, the likeness is most surprising. The manus of the Pangolins, on the other hand, although presenting some superficial resemblances, is formed on a different type, in most respects more conformable to that which is normal among mammals, but it has the peculiarity (which it shares with all known Carnivora) of connate scaphoid and lunar bones, and the ungual phalanges with deep median clefts, resemble those of *Perameles* among the Marsupials. Passing from the osteological characters, we find in the arrangements of the arterial system of the limbs, of the reproductive organs, both male and female, and the placenta, a close resemblance between the Sloths and Anteaters. In *Manis*, on the other hand, these important parts are formed on quite a different plan.

Many other minor considerations might be adduced which tend to establish the fact that *Manis*, if allied at all to *Myrmecophaga*, must have separated from the original common stock before this had given