ON
HIGH AMPUTATION FOR SENILE
GANGRENE.

BY
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MY wish in writing the present paper is to claim the attention of the Society to the advantages of amputation high up in all suitable cases of senile gangrene. The practice of amputation for this disease has I believe been almost universally discouraged from the belief that it is generally followed by sloughing of the stump. I wish to urge that this occurs only when the part is removed too near to the disease. If done low down then I fully admit that the condition of the vessels will rarely be found to be such as to admit of repair, and that gangrene of the stump will usually occur immediately, and place the patient's life in much more danger than before.

As regards these operations I have had but little experience, having long believed that they were most unadvisable. The few trials that I have made have fully confirmed this opinion, and I would abstain as scrupulously

in senile gangrene as in frost-bite, from any interference with the knife near to the dying part. If, however, we go much higher up and amputate through parts which are still well supplied with blood the results are quite different.

By operations of this kind I believe I have repeatedly saved the patient's life. By "amputation high up," I mean in the case of gangrene of the foot, above the knee, and in that of the hand at or near the shoulder-joint. By senile gangrene I mean chiefly gangrene in connection with calcification of arteries, but I wish to be understood to include all cognate conditions, that is, all in which the death of the part occurs in connection with slowly progressive interference with the supply of blood. In the strictly senile forms this interference is usually greatest in the distal part of the arterial system, and it is of a nature to be steadily on the increase. Hence the hopelessness of improvement and the great danger of advance. It is impossible that any collateral circulation can be established.

In cases of gangrene from occlusion of the main trunk without disease of the smaller branches, as for instance from embolism or from ligature, the conditions are different. Here there is hope that, when the collateral circulation shall have become established, repair will take place with exfoliation of the sphacelated parts. Yet there are some cases, even of this kind, for which I think high amputation may become advisable. Certainly, amputation near to the gangrenous part should always be avoided unless, indeed, when after repair has considerably advanced there is proof of well-restored circulation. Cases of frost-gangrene stand in some sense midway between these two classes; they are examples of gangrene from distal suspension of circulation as in the senile cases, but the cause is not, as in the latter, a permanent one. There is hope of restoration of the supply of blood. Nevertheless, all authorities are, I think, agreed that this restoration is never sufficiently perfect to make it wise to attempt the removal of the affected parts,

and that it is necessary to leave this almost absolutely to natural processes.

Before proceeding to narrate my cases it will be well that I should here introduce a brief summary of what has been done by others in the same direction.

The proposal to amputate high up in cases of senile gangrene is not absolutely novel. In fact a discussion which bore closely upon it took place in this room more than thirty years ago. On that occasion the late Mr. Garlike of Rickmansworth brought forward a case¹ in which he had amputated in the upper part of the thigh, in a man aged 69, who suffered from senile gangrene in his foot. There was ossification of the femoral artery, and there could be no doubt as to the real nature of the gangrene. The case, however, did not imply any proposal to amputate high up as the best treatment for gangrene of this kind, since it was only determined on after suppurative destruction of the knee-joint, when there was no longer any choice as to the site of the operation, and could be but little difference of opinion as to its absolute necessity.

The case, notwithstanding, is a good example of complete recovery under the somewhat desperate conditions referred to.

In the discussion which followed, Mr. John Adams, my late colleague at the London Hospital, mentioned a case of recovery after amputation for senile gangrene, but the precise part at which the amputation was done is not specified. Mr. Fergusson mentioned that he had operated in a single case, but without success, and spoke with decided disparagement of the practice. To Mr. James, of Exeter, belongs, I believe, the credit of having definitely proposed the line of practice which I shall endeavour to support. Indeed, I believe in one case that he actually did what I only proposed to do, but was not allowed by my patient to carry out, viz. to amputate both the lower extremities. I cannot find that any surgeon, writing since this discussion took place, has recom-

¹ 'Medical Times and Gazette,' 1853, vol. i.

mended the practice, or even thought it worthy of serious consideration.

Even before the date referred to, Mr. Langstaffe and Mr. Guthrie had each of them in single cases amputated above the knee for senile gangrene of the foot. Mr. Langstaffe's patient died in consequence of the hæmorrhage within twenty-four hours, but in Mr. Guthrie's case the stump was almost healed when death from exhaustion occurred. Mr. Mott had, I believe, also done a single operation of the same kind.

Thanks to modern improvements in the details of operations and the management of wounds, the surgeon of to-day approaches the subject with great advantages.

As regards the risk of hæmorrhage during the operation the use of Esmarch's bandage unquestionably gives much real assistance. The calcified arteries, even those of the smallest size, are very easily found, and if tied with their accompanying veins in one loop and with a moderately thick ligature, I believe no difficulty will be found in making them secure.

Some years ago I had a case in the hospital in which the conditions causing the gangrene were complicated and in which the safety and advantages of high amputation were very strikingly exemplified. The patient was a strong-looking man of not more than thirty who had served as a soldier in Canada. There he had suffered from frost-bite of the left foot. It was not, however, followed by immediate gangrene, and a year later he came into the London Hospital with an ulcer on the foot which had destroyed several toes, which would not heal, and which every now and then showed a tendency to spread at its edges by fresh sloughing.

After he had been some time under observation my colleague, Mr. Little, during the summer vacation amputated through the tarsus. When I resumed duty I found the face of the stump gangrenous and the condition of things worse than before. It was now discovered that the femoral artery in the thigh was obliterated. I decided to

amputate again and to do what I then considered a high operation. The leg from the ankle upwards was perfectly healthy, and I amputated just below the knee. The result, however, was that the gangrene attacked the stump, and this time it was an acute form and rapidly spread upwards. The man became exceedingly ill, sick, and delirious, and in this condition I amputated again high up in the thigh and with the most happy results. All the septicæmic symptoms at once subsided, and the stump subsequently healed perfectly.

It occurs to me as very possible that in this case the occlusion of the artery may have been the unsuspected cause of spreading gangrene which took place soon after the frost-bite. My next case seems to be an important item of evidence in this direction.

A man, æt. about 65, received a slight burn in the left hand. The result was spreading gangrene of the fingers, for which he came into the London Hospital. A large part of the hand was then black and sphacelated. We found that he had no pulse at the wrist and that his brachial artery was a solid thick cord. In the axillary, pulsation could be felt. During the next ten days the occlusion extended higher up and involved the axillary. The old man was very ill and clearly about to die if not relieved. I amputated just below the shoulder-joint and found the main artery completely plugged by a dense firm clot. The smaller branches were, however, pervious and bled freely. We had some difficulty with the wound, the edges of which sloughed a little. Ultimately, however, he recovered perfectly. In this case the arteries were not calcified, but very greatly enlarged and thickened. In the opposite limb the brachial artery was visible through the skin as a sinuous pulsating cord down the upper arm and in front of the elbow.

Encouraged by the result in this case, and about the same time, I amputated above the knee for an old gentleman living in Camberwell, but unsuccessfully. He sank within a week with gangrene of the stump. In this

instance the operation was done under most unfavorable circumstances and as a last chance. The patient was stout, in bad health, and the gangrene extensive and advancing. It was of the moist form, and the conditions were so urgent that I did the operation within a day or two of my first seeing the patient.

My next case was one of an ordinary form of senile gangrene of the right foot in a thin old man, *æt.* 72, in the London Hospital. He suffered also from prostatic retention of urine. Amputation above the knee was followed by good results so far as relief of pain and almost complete healing of the stump were concerned. The patient lived about five months afterwards, but never left his bed. He died ultimately from exhaustion by various causes, and with a gangrenous patch on the other foot. His arteries were very extensively calcareous.

In a fifth case I amputated for spreading senile gangrene of the left foot in an old woman, aged 75. She was suffering severely from the pain and irritation; was almost constantly delirious, and certainly not likely to live more than a week when the operation was done. She was, however, fortunately very thin. After the amputation she did well without an interruption. Her stump healed without a drop of pus and became perfectly sound. Her circulation was so feeble that we had great difficulty in preventing gangrene in the toes of the other foot, and had to keep it wrapped constantly in cotton wool. She returned home about a month after the amputation in tolerable health, but with the other foot still in a condition to cause great anxiety. I had advised her to have that limb removed also, as the best means of making the conclusion of her life comfortable and enabling her to leave her bed. It seemed certain that the toes would at once pass into gangrene if she were to sit up. My advice on this point was, however, declined by her friends. The removal of both lower extremities seemed to them a mutilation too formidable to be considered, and they took her out of the hospital.

The last case which I shall mention is one of unusual interest. The gangrene was senile in the sense that it was caused by calcareous arteries, but the patient was not advanced in years. He was much out of health from other causes, and the gangrenous process was preceded and attended by inflammatory action.

I attended Mr. H— in consultation with Mr. Linton Brunton, of Limehouse, whose relative he was. Mr. H— was only forty-eight, but he had worked hard and lived freely, and although not showing other signs of old age his arterial system had become most extensively calcareous. His pulse at the wrist was most feeble, so much so that frequently for days together it was scarcely perceptible. He was liable to become blue in the face on exposure to cold air, and suffered much from cold extremities. He had once at a railway station fallen unconscious, probably from cardiac syncope, and once or twice after mental excitement had been so prostrate that he was only kept alive by the freest use of brandy. Such being the state of his circulation, he was exposed one snowy day in 1880 to cold, and came home with his feet much chilled. Bullæ formed on his left foot and were followed by gangrenous patches of the skin and much swelling. The bones seemed to suffer more extensively than the skin, and abscesses subsequently formed about them. This might perhaps be explained to some extent by the fact that there was always a certain quantity of sugar in his urine. During the two months that I watched the case Mr. Brunton and I removed piecemeal many of the digital phalanges. Gradually the disease spread up the foot; abscesses with gangrenous patches of skin formed, and the ankle-joint became affected.

We obtained the advantage of a consultation with Dr. Mahomed on December 24th, 1880, concerning the state of the heart, &c. Dr. Mahomed used the sphygmograph and gave me a detailed written report. It was to the effect that there was no proof of arterial disease in the upper extremities, nor any of valvular disease

of the heart ; the latter organ was believed to be feeble, possibly dilated, and probably fatty. The pulse was described as "extremely small, non-persistent, readily compressed, short ; artery not thickened." The urine was found to contain a large amount of sugar and also a considerable quantity of albumen (about one sixteenth). It had a specific gravity of 1033. Mr. Linton Brunton had often before demonstrated the presence of sugar, but we had never found albumen, nor was it found subsequently.

Mr. H— had been most of this time in a condition of very urgent illness ; often vomiting everything for days together, and not in the least expected to live. Towards the end of February his general condition was a little better than it had been, but as the foot got worse and worse we decided to amputate at all hazards. This was done above the knee on February 27th, 1881. The elastic bandage and strap were used, and Lister's precautions fully carried out. When adapting the flaps the femoral artery was observed to project between them like a small bone, and I was obliged to forcibly bend it back. It had been cut in the flaps much longer than the bone, and I feared that we should have trouble with it during the healing of the stump. None such, however, occurred ; both the bone and it proved to be sufficiently covered, and the healing was immediate and without suppuration. It is now about three years since this amputation was performed, and the patient has remained well, wears an artificial limb, and gets about almost as well as formerly. His diabetes has for some time disappeared. He has lived more carefully, but has been much troubled by ulcerations on the other foot.

These cases do not include quite the whole of my experience respecting these operations. In a case under one of my colleagues in which, about six months ago, I had pleasure in giving my vote in favour of amputation, the result was, I believe, most satisfactory, and my friends have informed me of several others.

The facts adduced, I think, justify the belief that

amputation through the lower third of the thigh is not a very dangerous operation even in advanced years and with most extensive calcareous degeneration of the arteries. I have never in a single instance had any trouble with secondary hæmorrhage nor encountered any difficulty in securing the vessels at the time of operation. I have always tied with stout catgut or carbolised silk, and have taken up the tissues surrounding the artery freely. The smaller vessels have been twisted, but I have never trusted to this for the main trunk. If it be admitted that the operation is not in itself dangerous, then I think there can be no hesitation in believing that it offers a most acceptable alternative to the miseries of death from slowly advancing gangrene.