UPON

AMPUTATION IN DIABETES MELLITUS.

BY

W. G. SPENCER, M.S., M.B., F.R.C.S.,
ASSISTANT SURGEON, WESTMINSTER HOSPITAL.

Received March 4th—Read June 14th, 1892.

SUCH stress has been laid upon the danger from inflammatory complications in Diabetes Mellitus, that many writers condemn operative procedure without qualification, or at least omit to state the indications for it. Yet there is enough evidence, I believe, to show that, by the timely adoption of major amputations, life may be prolonged and the amount of sugar excreted reduced to a minimum in cases where the attempt to effect this by medicinal treatment, in the presence of a severe inflammatory lesion, has quite failed.

Many inflammatory lesions heal readily under the general treatment for diabetes combined with local anti-septic measures, such as boils, carbuncles, and gangrenous ulcerations of the penis. The following case shows that there is no want of repair in such patients.

CASE 1.—A carman, æt. 24 years, had suffered before coming under my care from increased frequency of micturition, excoriations on the penis which became gangrenous ulcers, and an abscess in the left groin which was incised,

the case being taken to be venereal. I could find no evidence of venereal infection, but, on the other hand, there was a large amount of sugar in the urine. The whole of the left lower extremity and scrotum were swollen, red, and painful from cutaneous erysipelas, whilst the sinus resulting from the incised abscess was discharging thin foul pus. After admission to the Westminster Hospital the inflammation in the leg subsided, and the ulcers upon the penis as well as the sinus in the groin healed. The urine was 1032 in specific gravity and 150 to 200 oz. (4.25 to 5.67 litres) in amount, the sugar being 8 grs. to the oz. (1.8 grms. per 100 c.c.). He took codeia and a full diet from which starch was withdrawn. Three weeks after his discharge, whilst upon the same medicine and diet, he died in diabetic coma. This fatal termination proves that the patient was suffering from a malignant form of diabetes, but one which did not prevent his recovery from an acute attack of erysipelas less than six weeks before the end.

The two following cases under my care, very similar in character, illustrate the failure to treat in the one case, and the success following amputation of a diseased limb in the other.

CASE 2.—A hairdresser, æt. 51, was admitted to the Westminster Hospital on September 7th, 1887, with a wound on the inner side of the left knee. A week before he was using a chisel, when the instrument slipped, and the blow drove it into the left leg on the inner side of the patella. The small wound bled slightly, and he covered it with some rag. After two days his knee became painful. For two years he had suffered from excessive thirst and increased frequency of micturition. He had also drunk hard. The lower part of the thigh and knee were obviously swollen, and when pressure was made upon the patella pus spurted from the wound. Temperature 100.4° F. Urine acid, 1040; no albumen; a large quantity of sugar. The

wound was found to be the orifice of a large cavity placed on the inner side of the knee, which communicated with the joint and with another abscess cavity beneath the quadriceps extensor tendon. The cavities were drained and constantly washed out. Bread and potatoes were withdrawn from an otherwise full diet, codeia, ammonia, and bark being also administered.

For the next week his temperature varied from 99° F. to 100° F.; the amount of urine was about 100 oz. per diem (2·8 litres), containing about 20 grs. to the oz. (4·4 grms. per 100 c.c.). Drainage was good, but it was obvious that his life could only be saved by amputation. I then believed that amputation in diabetes mellitus was sure to be followed by gangrene of the stump and death.

He died on September 20th in diabetic coma, the temperature rising to 104° F., and the breath becoming sweet.

At the post-mortem the cadaver had a well-marked sweet odour, the kidneys were slightly granular, the abscess cavities almost surrounded the lower third of the femur, but there was no collection of pus, nor any bone bare. The arteries and veins of the limb as well as the rest of the body were quite healthy.

I fortunately treated the following very similar case in a better way.

CASE 3.—A tailor, æt. 56, had for some time suffered from a dry sore mouth, from an irritable skin, and great thirst. He had formerly drunk spirits freely, but latterly four pints of beer daily. On August 29th, 1892, he felt pain over the thenar eminence which gradually extended to the left arm. On September 1st he first noticed a swelling behind the elbow, and was admitted to Westminster Hospital on September 2nd. He could not move his arm, which was swollen from above the elbow to the middle of forearm, being about double the size of the right, was hot, and of a dusky red colour. The olecranon bursa was distended, and a quantity of blood-stained serous fluid escaped

on incision. There was much sugar and a trace of albumen in the urine.

He was placed upon a full diet excluding bread, potatoes, and sugar. Opium was administered, and the arm kept in a boric acid arm-bath. The swelling of the arm did not go down. The temperature rose to 101° — 102° F. at night. The urine passed was about 70 oz. (2 litres), sp. gr. 1035—1042, containing about 10 grs. to the oz. (2.2 grms. per 100 c.c.). On September 8th I extended the bursal incision upwards above the olecranon through the triceps. A quantity of pus escaped, and the lower third of the posterior surface of the humerus was found to be bare. The pus had also burrowed into the subcutaneous tissue, but the joint had practically escaped.

I urged the patient on the next day to submit to amputation, but he steadily refused. Although all care was taken of the drainage, the suppuration became daily more profuse, and the sugar excreted was quite uninfluenced by the medicinal and dietary treatment. On September 21st the patient had become prostrate, semi-comatose, with incontinence of urine and fæces, and then the patient's friends consented to the amputation. This I did on September 22nd, amputating the left arm at the level of the attachment of the deltoid. Unfortunately this was below a small line of inflammatory induration which had extended up along the course of the basilic vein to the level of the coracoid process. Owing to the delay I could not have obtained flaps completely free from inflammation even by the more severe operation through the shoulder-joint. The artery was quite healthy. The stump itself appeared to heal by first intention, but the inflammation along the basilic vein formed a superficial abscess which required incision, and later on a counter opening had to be made to finally cure a sinus which persisted. He went to a convalescent home in the middle of December, and returned in January with the stump healed, feeling well, and having gained much weight. The result of the operation upon the temperature was that it became subnormal for a fort-

night, then normal. The specific gravity of the urine fell from 1036 on the day of operation to 1023, then gradually rose during the development of the abscess, remained at 1030 during the persistence of the sinus, and has finally fallen to 1023. The sugar fell from 10 grs. to 2 grs. to the ounce, then rose to 8 grs., and finally returned to $1\frac{1}{2}$ grs. During recovery opium and codeia appeared of no service, and were omitted; but after healing of the stump, codeia being again given, the sugar was reduced to a well-marked trace (*vide* Chart).

This case shows that the amount of sugar excreted by a chronic diabetic is greatly increased by an inflammatory affection, and it illustrates the inefficacy of the drug and diet treatment. Had the operation been done earlier, I believe that the wound would have healed by the first intention, and the sugar excreted have fallen to a minimum at once.

The severest inflammatory complication in cases of diabetes mellitus is that of gangrene, but I would submit that there is good evidence to show that the sugar in the urine is not the cardinal factor upon which the plan of treatment ought to turn, but is only one of several. The gangrene scarcely ever occurs in patients below forty years of age; it is absent in the more malignant forms of diabetes, and it nearly always appears in chronic diabetics who present along with the gangrene an exacerbation of the glycosuria. A large majority of such cases have arterial sclerosis, affecting especially the vessels of the leg, and the gangrene commences like senile gangrene. More rarely the nerves are affected, and the first lesion is a perforating ulcer.

Again, many cases present conditions of impaired nutrition due to gout, alcohol, or chronic renal disease.

I would, therefore, urge that a consideration of the recorded cases leads to the conclusion that the failure of amputation for diabetic gangrene has been due to one or more of the following causes:

The dotted line - - - - indicates the amount of sugar in the urine. The thick line is the temperature chart.

1. Amputating through the leg when the arteries have already become occluded.

2. Amputating through inflamed tissue, or by septic inoculation, formerly, of the wound at the operation.

3. Postponement of the operation till too late, especially after the urine has become albuminous.

Of these I must lay most stress upon the failure from operating too low. Success has been obtained when the above causes have been excluded. Thus Mr. Hutchinson has recorded one case in his important paper in the volume of the Society's 'Transactions' on high amputation for senile gangrene. Other cases have been recorded by Professors Roser and König, who have for a long time been in favour of amputation; also by Kraske. But the most important paper has only lately come to my notice by Heidenhain, giving an account of Professor Küster's operations. Twenty-five cases of senile and diabetic gangrene were treated by amputation, all of the lower limbs. Fourteen were cases of senile gangrene only, and the mortality five. Eleven were in diabetics, and the mortality was also five. But if we look nearer at the five fatalities in diabetes mellitus, this result is seen not to militate against operation. One was in diabetic coma, at the time with 5 per cent. sugar; death took place in twenty-four hours, the coma persisting. The second case underwent amputation through both thighs at a week's interval, having 8 per cent. of sugar. He died at the end of nine days from sudden pulmonary œdema and coma. Both stumps were in course of healing by first intention. A third case also underwent a double amputation through the thigh at three months' interval. At the second operation he had 1·3 per cent. sugar and one fifth albumen. He died after five days in coma, the stump being in process of healing by first intention. The fourth case had much sugar and two thirds albumen; he also died after five days, the amputation wound through the thigh tending to heal without suppuration. The fifth case was reported to be a diabetic, but had no sugar

before nor after the operation, only much albumen ; he died on the fifty-eighth day, after amputation through the thigh, of cardiac failure. The diabetes in these cases appears not to have affected the healing of the wound. In the three cases dying in diabetic coma, after five and nine days, the stumps were healing by first intention. In three of the cases albumen was present in large amount. Of the six recoveries after amputation through the thigh two healed by first intention, the other four after more or less ulceration.

The sugar before operation was (1) "large ;" (2) 5 per cent. ; (3) 3·6 per cent. with one third albumen ; (4) 2 per cent. ; (5) 1 per cent. ; (6) a trace, and fell very much in all the cases after operation.

A most important point in the paper is the evidence in favour of high amputation. Of the twenty-five cases twenty had arterio-sclerosis, and in eleven of these the vessels of the leg were almost completely occluded by thrombi.

Professor Küster amputated low down in some of the earlier cases. In four cases a toe was removed, which was followed by gangrene of the foot. One case died of sepsis after a secondary Lisfranc (1871), one recovered after a secondary amputation through the leg and a tertiary amputation through the thigh. The other two recovered after secondary amputation through the thigh.

Three cases of Chopart's amputation were likewise followed by gangrene, and all three recovered after a secondary amputation through the thigh.

Of six amputations through the leg, one died of gangrene and sepsis. Two healed after limited ulceration and necrosis, and three recovered after a secondary amputation through the thigh. Two cases were amputated through the knee-joint ; one healed by first intention, one after secondary amputation through the thigh. The long anterior flap of this operation is so likely to fail if there is any arterial narrowing.

I have only met with the account of three cases of

amputation through the leg in diabetics which were successful, all three after some ulceration and necrosis. König had two cases, the sugar being 4 per cent. and 2.22 per cent., which after healing had become a trace. One was under Mr. Langton at St. Bartholomew's, which he has kindly allowed me to mention.

CASE 4.—A carpenter, æt. 65, the subject of gout and addicted to alcohol, began to suffer, May, 1884, from gangrene of the toes of the left foot. His arteries were markedly calcareous, distinct rings being felt in the radial vessels. The urine varied between three and four pints (2 litres), containing five grains to the ounce (1.1 gramme per 100 c.c.) of sugar, and some albumen. The leg was amputated through the lower third on July 31st; the vessels were very calcareous, and the stump was finally healed in April, 1885, after limited ulceration and necrosis. The recovery was complicated by the occurrence of boils, carbuncle, and by local gangrene of the opposite foot. On his discharge the urine contained only a trace of sugar and no albumen.

Primary union, therefore, can only be expected after a high operation.

Diabetic gangrene, whilst still limited to a toe, can often be arrested, as in the case of a woman under my care, who had suffered from diabetes mellitus for more than five years before gangrene occurred for the first time. It recurred twice, in the same toe on all three occasions, yielding to treatment, but I have not met with any case of recovery when the deeper structures of the foot have become involved. A line of demarcation may form round the base of the toe and yet prove deceptive, because the gangrenous process continues to burrow insidiously along planes of fascia and tendon-sheaths. Sir James Paget has emphasised this point, and I have observed the same thing.

Perforating ulcers, however, offer a more favorable prognosis, be it that the discharge can be prevented from

accumulating, or that the vessels remain relatively sound. I have had one case of extensive ulcers which healed, and Mr. Thomas Smith mentioned another to me in which the foot appeared to be bored through by several sinuses, and yet healing finally took place.

In all the cases referred to in this communication amputation was performed because a fatal issue was imminent, so that the recoveries represent so many lives prolonged. The amount of sugar before operation and its existence after, although much reduced in quantity, establishes the existence of diabetes mellitus in them.

And I believe that similar successes will be obtained in the future—(1) by adopting a high amputation; (2) by avoiding the delay involved in the attempt to reduce the sugar by drugs and diet in the face of a severe inflammatory complication.

To put the conclusions in another form, diabetic gangrene should be operated upon by following the rules already established for other forms of gangrene.

Note (June, 1892).—The patient continues in good general health, and was shown at the meeting; the stump has quite healed. Since becoming an out-patient the diet has not been so well adhered to, and the sugar in the urine has varied. The sp. gr. was on one occasion 1032, on another 1019.

REFERENCES.

HEIDENHAIN.—Ueber die Behandlung der senilen Gangrän der unteren Extremität, insbesondere bei Diabetikern. Deutsche medicinische Wochenschrift, 1891, s. 1087 (Professor Küster's cases).

HUTCHINSON.—High Amputation for Senile Gangrene. Med.-Chir. Trans., 1884, lxxvii, p. 97.

KÖNIG.—Zur Revision der Lehre ueber die Vornahme grosser Operation (Amputationen) bei diabetischem Brand. Centralblatt für Chirurgie, 1887, s. 225.

KRASKE.—Diabetes und Sepsis. Centralblatt für Chirurgie, 1881, No. 35.

LANGTON, J.—Notes of an Unpublished Case.

ROSER.—Diabetes und Sepsis. Deutsche medicinische Wochenschrift, 1880, Nos. 1 and 2.

PAGET, Sir J.—Studies of old Case-books, 1891, p. 116.
Diabetic Gangrene.

SMITH, THOMAS.—Notes of an Unpublished Case.