

ence of a neuroma which will not permit satisfactory regeneration and warrants surgical interference.

If the zone of formication is shorter than it should be according to the duration of the period of regeneration, it must be determined whether there is a second lesion, perhaps one wholly unsuspected, not a rare occurrence in war patients with multiple wounds.

#### CONSIDERATION OF THE CRITICISMS OF THE TEST

A full consideration of the criticisms of the test cannot be fully gone into at this time, but are to appear in a later publication.

The presence of formication with complete interruption of the nerve is the most common objection raised by various writers.

The speaker agrees with the statement that formication is frequently present with complete section of the nerve and more or less separation of the nerve ends. This formication is due to the penetration of a few sensory fibres through the scar tissue and into the peripheral sheath. A few nerve fibres pursuing an indirect course through scar tissue and between widely divided nerve ends may be inconspicuous at operation so that the case will be classified as one of complete section. In these cases formication is habitually of little intensity as compared with that elicited at the proximal nerve end, and the rate of regeneration is frequently sub-normal, so, with the technique advocated in this paper the diagnosis of complete separation should be made in these cases.

Another frequent criticism is that the formication elicited is no indication as to whether the proportion of regenerating nerve fibres will be sufficient to result in satisfactory recovery. A comparison of the intensities of the formication as recommended above will negate this objection.

A third and frequent objection is that formication is found at a lower level than regeneration could possibly account for. This comes from the failure to mark the limitations and accurately measure the zone, and to avoid stimulating the nerve at a distance by relieving the tension on the shortened nerve. We have no laboratory evidence to answer the objection that the rate of regeneration of sensory fibres is not the same as that of motor fibres, but our clinical experience allows us to state that there is a close correspondence between the two.

Much of the criticism depends upon the misconception that the presence of *any formication* means regeneration and contraindicates surgical intervention.

#### THE VALUE OF THE TEST

Complete interruption is indicated by fixity of formication at the level of the lesion on repeated examinations, or by formication of diminished intensity below the level of the lesion and of sub-normal rate of regeneration. Either finding should warrant surgical exploration.

In our war experience we came to feel that a considerable proportion of cases should be operated on comparatively early, about three to

four months after healing of the wound, not alone for the direct exploration of the nerve, but for the removal of large adherent scars. The patients appreciated the removal of these unsightly scars and the vascular disturbances were usually less after such surgical procedures. The formication test rendered such early operations devoid of danger in that formication of good intensity and of normal rate below the lesion called for a neurolysis instead of resection and suture in doubtful cases.

The formication test gives definite evidence of regeneration long before muscle reflexes appear or before voluntary motion becomes possible. It frequently tells us when a suture has been unsuccessful, as may happen when the ends pull apart after having been sutured under some unavoidable tension.

There are additional minor points of value in the test, in that it often indicates the position of a neuroma under a long scar and helps in locating the nerve ends at operation and in telling whether a suspicious palpable mass is a neuroma or not, or in revealing a second unsuspected lesion, and finally, it is of great value in helping to keep up the morale of the patient during the long period before the reappearance of voluntary motion.

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#### EXPERIENCES IN TESTICLE TRANSPLANTATION.\*

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During the past two years eleven men have been operated upon at San Quentin prison for the implantation of human testes taken from recently executed convicts.

In the past four months, twenty-one have had implanted in them testicular material taken from young rams.

This work was done to substantiate, or disprove the assertions and claims made by various writers, particularly Lydston of Chicago, whose reports have appeared in medical journals, and later by Voronoff of Paris, and Brinckley of Milford, Kansas, who through the daily press under their own signatures have made statements which have aroused the curiosity of the public and have instilled into some unfortunates, the hope of longevity and eternal youth.

The first case, reported by Dr. Frank Lydston (in the *Journal of the American Medical Association*, February 8, 1919, volume seventy-two, number six, page 397), operated on at San Quentin Prison in August, 1918, was a man age twenty-five years, who subsequent to a kick in the scrotum at the age of twenty, had had atrophy of the testicles, with diminished sexual activity as well as mental and physical languor.

Two testicles removed from a negro, age twenty-seven were embedded in the pampiniform

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plexus of the recipient, using spinal anesthesia. The recovery was uneventful.

Three months after the operation the patient had shown considerable improvement physically, mentally and sexually. He moved more quickly, had more expression to his face, and gained fifteen pounds in weight.

Sexually he had frequent erections, even having them in the day time, something he had not experienced since his accident.

In June, 1919, he was paroled to a saw mill, where he served as a car loader. The superintendent reported that he was better than the average laborer, and did his work very satisfactorily.

In April, 1920, he returned to San Francisco. An examination of the implants showed them to have atrophied to the size of cherry pits, but he claimed his sexual activity had not diminished, and that he felt quite energetic. These manifestations contrast markedly from his demeanor previous to the operation.

Cases two and three each received one testicle taken from a Mexican, age 27, who was executed in February, 1919.

Number two was a boy, aged 20, who was kicked in the scrotum in a football game. Atrophy ensued, accompanied by lessened sexual desire and decreased mental and physical activity. After the implant he had frequent erections, and declared that he felt 100 per cent. more passionate, besides feeling better in every way. One year after the operation the implant had atrophied to size of ordinary cherry, but the good effects still persisted.

At the present time, fourteen months after, there has been no diminution of the benefits derived and the patient feels fine.

Number three, age 50, had impotence following an orchitis. With his lack of sexual powers there was also a diminished mental and physical vigor. Following the implantation he became more alert, brighter, and had daily erections. He asserted that he felt better than he had for years, and that his passion was as great as it had been when he was twenty-one. After eight months the implant had reduced to about half the size, and the libido sexualis had somewhat decreased. Consent was given to have the graft removed.

Microscopical examination showed it to be entirely necrotic, with slight ingrowth of cellular connective tissue into the necrotic capsule.

Case four, age 50, had testicles injured in 1910. His general health and sexual vigor diminished.

In June, 1919, two testes removed from a man age 26 were grafted on to his own atrophied glands, by cutting flat surfaces on the testicle of the recipient, and on the ingraft, sewing them together with Lembert sutures. The wound healed well, and the patient had an erection five days after the operation. From this time on he has had daily erections, with no diminution in his libido sexualis. He has improved in demeanor, is energetic, enjoys living, and has gained in strength and in weight, from 150 pounds to 194 pounds. The oculist reports that this man's eyesight has

improved fifty per cent (50%), and the patient himself often speaks of the improvement.

*Patient five*, age 70, had double testicle anastomosis. There was some sloughing from both sides after a week, but in spite of this the patient derived much benefit, not only in physical well being, but in mental alertness. He continues after eleven months to have frequent erections, and often remarks about his good health and high spirits, which he attributes to the gland transplantation.

This change for the better is noticeable by daily observations of him.

*The sixth patient* was operated on in July, 1919, two testes removed from a Japanese, age 38 being engrafted. This man claims to have always been strong sexually, although his testicles were atrophied to the size of almond kernels, due to injury when age 16. His actions, and general characteristics were rather feminine, having broad hips, abnormal obesity, high voice and many female mannerisms. Two weeks after the operation both implants began sloughing, and within a month had been almost entirely thrown off. The patient declared he had received no benefit from the procedure, and that his libido sexualis had in no way been affected. It was reported by the choir leader that the voice had changed from a high tenor to a low tenor. This change was remarked by others.

On April 26, 1920, a slice of ram's testicle was imbedded into the abdominal wall of this same patient. Two days later he had an erection, and felt very well.

*Patient seven*, age 44, had been sexually strong up to eleven years ago, when he injured testicle by falling astride scaffolding. In September, 1919, one testicle was transplanted in his scrotum from a Mexican age 37. He had several erections following this, but in ten days the wound broke open and later on most of the gland sloughed out. The patient felt that the operation had little beneficial effect in any way upon him. In appearance he is improved, but this may be attributable to the regularity of prison life. He is anxious to receive another implant.

*Number eight*, negro, age 50, was divorced because of his sexual inability, due to a crushing injury sustained to his testicles.

In September, 1919, single testicle graft was made, the material being taken from same donor as previous case.

Two days afterward, patient had a slight erection. Gradually these erections became more frequent, and with greater libido, much to the patient's satisfaction. There was some sloughing in this case also, but considerable of the graft healed in. This patient experienced a better state of health and mind, and felt much benefited. He likewise stated that his eyesight was better. This was not substantiated by tests.

*Case nine*, age 48, had decreased sexual powers, languor and mental torpidity, since the age of 25, when he fell astride a wheel, injuring his testicles. He never married, and only had sexual desires when full of liquor. Then he had difficulty in

consummating the act. He was sent to prison for lewd and lascivious conduct with a minor girl. Examination and observation showed him to be fairly well developed, and very lazy, dull and inactive.

In July, 1919, a double graft, taken from a Japanese, age 38, was made. Within two days after the operation, the patient began to have erections, and now after ten months there is no diminution. In addition to this, he became alert, and more active, doing his work energetically, and with pleasure. He feels that his whole outlook on life, has changed for the better.

*Number ten* was operated on October, 1919, one testicle being embedded, and one engrafted. The donor was a Portuguese, age 40. The recipient, age 56, was kicked in scrotum, and for past twenty-five years had had no erections or sexual desires. Three days after the implant, he had his first sexual manifestation in that period. He continued to have erections, felt improved, and experienced renewed vigor. Recently the implant broke through the surface, and some of it came out, but the graft is intact, and only slightly diminished in size. But with this man there has recently been a diminution in his sexual desires. The effect is probably wearing off, although he feels very well otherwise.

Case eleven will be reported in full at another time.

On account of the scarcity of human material, it was determined to use the testicles taken from young rams.

Two old men were selected, who had been devoid of sexual activity for years. On January 21, 1920, these men were operated on with spinal anesthesia, and the whole ram's testicle (about the size of a turkey's egg) was placed in each scrotum.

In one case, F., pressure necrosis set in within a few days, and within a week the whole gland came away. Some connection by plastic material had been made to the graft as it clung to the scrotal tissues when being removed. This patient derived no benefit whatever from the implant. On April 27, 1920, a slice of ram's testicle was implanted in his abdominal wall.

The other case, P., retained the gland for three weeks but after this time, much of it sloughed out.

However, this man, age 75 years, had nightly erections and improved very much physically, following the operation. He had been sexually dormant for five years, up until this time. Officers of the prison who did not know that this man had been operated on, remarked about the change in his appearance and actions.

Believing that the sloughing occurred as a result of the large size of the implant, three cases were operated on March 11, 1920, using only half a ram's testicle. One of these was a sexual neurasthenic, who felt improved after the operation, and had increased sexual vigor, but lately reported that he felt the work had done him no good.

*The second case* was a physician suffering from

paralysis agitans. He had a good erection three nights after the operation, but his tremor seemed to have been increased. Three weeks afterward, he reported that he felt all right but could not tell just how much he had been helped.

*The third case* was a boy, age 20, who had a testicle removed following a hernia operation. He had increased sexual activity, and improved mentally. In all these three cases much of the implant sloughed after a week.

On April 3, 1920, two cases were operated on by placing only a slice of the ram's testes in the scrotum over the pampiniform plexus.

Of these cases, K., age 35, had had seminal vesiculectomy in 1918, since which time he has been impotent. Two days after the implant he had an erection, and has continued to have them almost daily.

Case W., a negro, age 45, had had sexual lassitude for two years. The second day after the implant he had erection, and has had one daily since. One month after the operation the wound opened up, and most of the gland sloughed out.

Of the other two cases, in this series of four, the slice of testicle was placed in the abdominal wall. There has been no sloughing, and the patients have felt better. Although these men are older than the other two, being 59 and 66 respectively, they have had only a few erections.

On April 27, 1920, seven cases were treated with slices of ram's testicle in the abdominal wall. These were implanted twenty-four hours after removal from the ram. On April 29, 1920, three more were operated on, using the same material which had been frozen in vaseline for seventy-two hours. It is too short time to yet record the results in these cases.

But now after two weeks, all of them seem to have been benefited, and sexually stimulated, except one who has a pleural effusion and is quite ill.

On May 4, 1920, three men were implanted with slices of ram's testicle which had been frozen at 12° F., in vaseline for eight days. So far the effects seem to be as good as with the fresh.

In conclusion it may be said that the implanting of testicular material has a stimulating and invigorating effect upon the recipient sexually as well as mentally and physically.

The implant does not live but becomes necrotic. But in this process of necrosis certain unknown substances are probably released into the system.

The glands of rams seem to be as effective as the human.

These glands may be preserved for a week, and perhaps longer, by immersion in vaseline and freezing.

There seems less likelihood of the implant sloughing out, when placed in the abdomen, than in the scrotum.

With the abdominal implant the patient need be in bed for only one day.

Any means which will increase the physical well being of an individual, as this process does, will tend to increase longevity.