and his knee was then found to be swollen and acutely tender. Pathological examination of the joint fluid showed that pus cells and streptococci were present. The patient was continually asking for the leg to be amputated.

On January 12th it was decided to give the treatment above described a trial. This was carried out, and his condition rapidly improved, the temperature becoming normal on January 16th, and remaining so till his discharge. Several sequestra were subsequently removed from the site of the fracture. The Thomas splint was retained longer than usual owing to the condition of the fracture. He was discharged from hospital on February 24th. The patient now walks with a stick, and can flex his knee to a right angle.

CASE III.

A. R., a boy aged 11 years, was admitted to the Royal Infirmary on January 29th, 1920, with a dirty wound over the left knee-joint, the result of a fall some days earlier. The wound did not appear to communicate with the joint, and he was sent home on February 2nd.

He was readmitted to hospital on February 16th. The knee was painful and swollen, and his temperature was 103.6° F. X-ray examination showed no bony injury. The joint was aspirated on several occasions, and pus cells and staphylococci were found present. As the joint repeatedly filled up and his temperature reached 104° F. the procedure described was adopted. The temperature dropped slowly and his condition rapidly improved. He was discharged on March 24th, the wounds being healed. The knee-joint could be flexed about 45 degrees at that time. I have not seen the boy since that date.

CASE IV.

E. J., a boy aged 16 years, was admitted to the Royal Infirmary on February 3rd, 1921, suffering from acute osteomyelitis of the right tibia. Operation was carried out for this condition the same day, when the medullary cavity of the tibia was freely opened.

His progress continued satisfactory till March 1st, when the right knee-joint was found to be painful and swollen. Aspiration of the joint showed pus cells and streptococci to be present. The joint was therefore opened, washed out, and bipp applied, the limb being placed in a Thomas splint. The right elbow-joint also became involved and was treated on similar lines, lateral incisions being made either side of the olecranon.

A streptococcal vaccine was prepared from the pus by Dr. G. E. Loveday, and injections given at regular intervals. This additional treatment contributed in no small degree to the successful result of the case. His subsequent progress was satisfactory, both joints quickly cleared up, but the wound of the tibia continued discharging pus. He is still receiving hospital treatment for this condition, and massage to the affected joints, which are slowly improving.

CONCLUSIONS.

1. The insertion of drainage tubes into the knee-joint is not only unnecessary, but harmful in acute arthritis. If thorough irrigation with saline is carried out at an early stage, the synovial membrane lining the joint can safely overcome the septic infection aided by the application of bipp.

2. The joint cavity must be left open after the irrigation, otherwise the pus will reaccumulate under pressure, and, burrowing through the capsule, spread in the fascial planes.

3. Extension must be applied to the limb during the early stages to separate the articular surfaces and prevent erosion of the cartilages at the site of pressure.

4. Mobilization and massage must be instituted as soon as the stage of active inflammation has subsided, usually within fourteen days.

REFERENCES.

¹ Gray, *The Early Treatment of War Wounds*. ² *Lancet*, July 10th, 1920, p. 81.

THE RESULTS OF NINETY-EIGHT CASES OF NERVE SUTURE.

BY

PAUL G. DANE, M.D. MELB.

IN the *Medical Journal of Australia*, July 26th, 1919, I reported the results of my observations, extending over two years, on 63 cases of nerve suture, comprising 23 cases of suture of ulnar nerve, 14 of median, 12 of musculo-spiral, 13 of sciatic, and one case of musculo-cutaneous nerve of arm.

This number has been amplified since by the addition of other cases, and the original cases have been revised, so

that 98 cases of nerve suture are now presented, arranged in six series as follows:

1. Ulnar series ...	35 cases
2. Median series ...	20 "
3. Musculo-spiral series ...	15 "
4. Sciatic series ...	22 "
5. Musculo-cutaneous ...	1 "
6. Brachial plexus ...	5 "
	98 "

These cases are entirely unselected—they are taken seriatim from the card records of the Massage Department, No. 5 Australian General Hospital, Melbourne, and all are the result of gunshot wounds, and have been under observation for from twelve to thirty-six months.

The results of operative treatment on these various groups will now be given, and following that a more detailed study of them will be touched upon. On deciding as to recovery I have taken the amount of motor recovery as the standard, it being much more important from a practical standpoint, and much more easy to determine accurately and quickly than sensory return; but as a rule sensory recovery was more complete and earlier than return of motor power.

The groups of cases are divided into four classes: Perfect results; Good; Fair; and Bad results. Under the column "Perfect" are grouped cases that have gone on to full motor and sensory recovery, even though the muscular power be feeble, as it is in a great many cases; under "Good" are found cases where there has been a recovery of muscles subserving gross movements, such as the long flexors in the forearm or the gastrocnemius or tibialis anticus in the leg, but where the muscles subserving finer movements, such as the intrinsic muscles of the hand, have not recovered. In my former paper I also included under this group cases that had a probability of further recovery, but it is hardly necessary to do this now, as the cases have been under observation so much longer. In the group labelled "Fair" are cases that have recovered to a more limited extent, and under "Bad" are cases that have not recovered any function.

Table showing Results in 98 Cases of Nerve Suture.

Nerve.	Perfect.	Good.	Fair.	Bad.	Total.
Ulnar ...	8	12	3	12	35
Median ...	5	4	5	6	20
Musculo-spiral ...	5	3	3	4	15
Sciatic ...	6	4	2	10	22
Musculo-cutaneous ...	0	1	0	0	1
Brachial plexus ...	1	1	2	1	5
Total ...	25	25	15	33	98
Per cent. ...	25.5	25.5	15.3	33.6	

By this table it is seen that 25.5 per cent. of the cases have gone on to perfect recovery, whereas 49 per cent. (the last two groups) are practically failures, but if we add together the first two columns as constituting good results we get 51 per cent. of good results as against 49 per cent. of bad results. However, I do not think that we can regard the results purely in this manner, as each individual case must be considered by itself; for instance, in the "Perfect" group of 25 cases only 11 cases regained full motor power—by that I mean regained a perfectly useful limb of the same functional capacity as before the wound; in the majority of cases many of the muscles that regain movement remain weak and atrophic.

The explanation of this fact involves many factors, such as concomitant injury to blood vessels, other nerve trunks, sepsis, and improper pre-operative and post-operative treatment—probably more to this last factor than anything else.

A few of these points are now indicated:

Ulnar Nerve Series.—Sixteen cases had also an injury to the median nerve, and one of these had in addition the musculo-spiral severed. Three of these had also the main artery ligatured.

Median Nerve Series.—Nine of these had the ulnar nerve injured, and one had in addition the musculo-spiral nerve severed; one case had both main arterial trunks ligatured.

Sciatic Nerve Series.—Ten of these were suture of external popliteal and the remainder were cases in which the whole sciatic had been severed. Of the former four gained a perfect result, and of the latter only two gained a perfect result.

Throughout the whole six series of 98 cases the only ones which had any proper pre-operative or post-operative treatment by means of splints were a few of the musculo-spiral cases. In the great majority of cases it was not until patients came to our department that any postural treatment was adopted, and in many cases months elapsed between the wound and operation, and between the latter and admission to our department. The results of these six series of cases, aggregating 98 in all, do not agree with some of the glowing reports found in the literature. Professor Tinell in his book estimated that 85 per cent. of his cases had recovered or would recover. He of course acknowledges that all were under the best circumstances for recovery, whatever he means by that. Even taking the most liberal estimate of my cases we find that 51 per cent. represents the standard of recovery, and I feel sure that this figure greatly exceeds the real truth, especially if one regards recovery from the point of functional usefulness apart from mere academic recovery of muscle movement. I have erred on the liberal side in estimating recovery, and do not think that many of the cases (if any) in column "Good" will progress any further.

The results on the whole, then, are in some measure disappointing, considering the tremendous amount of regenerative power that the axis cylinders possess, probably more than any other tissues in the body; and yet the results are encouraging when one considers the many unfavourable factors militating against success in almost every case. Some of these factors have been mentioned above and need not be here reconsidered. The question of the lapse of time between receipt of injury and suture of nerve is very hard to evaluate. Some cases that were operated upon a few hours after being wounded did badly, whereas others which were not operated upon for months did well. Of the operative technique I cannot speak, as cases were done by many different surgeons, but I feel sure that it was good, as the majority were operated upon by surgeons whose ability is well known.

A big factor associated, as I have before stated, with practically every case has been the neglect of pre-operative and post-operative postural treatment by means of splints, etc. This neglect, I feel sure, has been responsible for most of the failures, especially with regard to the delicate intrinsic muscles of the hand. It is not to be expected that these muscles will recover so easily as the other larger muscles. Being situated more distally they are at a marked disadvantage from the point of view, first, of time required for processes to grow into them; secondly, the small size of the nerve trunk as it spreads peripherally renders the march of the new processes more difficult, and these small muscles are pulled out of position very easily by the contracture of antagonistic groups, and this with such delicate organs must greatly injure them.

With regard to post-operative treatment, I have not been much impressed with electrical methods, and in future I shall not employ them at all, or only to a very limited extent. It is impossible to know exactly what one is doing in many cases, and probably more harm than good results from violent shocks to sick muscle engines. Scheft showed in 1851, and Professor Langley confirmed his results (*Journal of Physiology*, July, 1916), that a denervated muscle is in a state of fibrillation. It seems to me that, such being the case, it is the height of absurdity to send comparatively violent electrical stimuli into a muscle in a condition like this. There is one thing above all that it requires, and that is rest—complete rest—and this can only be done by the application of appropriate splints, so as to control all joints over which the muscle acts, thus placing it in a condition of maximum relaxation. This is difficult to obtain fully in many cases, but it is the end to be aimed at, and ingenuity and experience can enable one to design splints, etc., to do this.

Hartman and Blaky, in an extensive research on the subject reported in the *Journal of the American Medical Association*, March 22nd, 1920, performed a series of experiments on rabbits, denervating the muscles of the hind legs, and then applying the recognized forms of treatment. They came to the conclusion that neither massage nor

galvanism had the slightest effect in preventing atrophy of muscles—the only positive conclusion that they came to was that the more perfect the coaptation of the divided nerves the more perfect was the result. They did not try the effect of splinting or postural treatment at all; in fact, they used passive movements daily, which to my mind rather vitiates their results, as, unless these movements are done very carefully, stretching of the sick muscle results and does harm, as W. C. Mackenzie has shown in his work on the paralyses following acute anterior poliomyelitis.

I am convinced that we have as a profession not yet grasped the overwhelming importance of rest—perfect rest—and gradual re-education to muscles that have been injured by denervation from whatever cause. In Australia we should have wakened up to this problem much sooner, as it has been preached to us for the past ten years. It must be emphasized that a denervated muscle is a sick muscle (sick unto death almost), and that we must apply to it the cardinal principle that runs all through our treatment of almost every pathological condition. This applies much more forcibly to such small muscles as the intrinsic muscles of the hand and the muscles of the face, more especially as these are always placed at a great disadvantage by the stretching of the antagonistic groups.

As regards recovery of sensation, my experience has been that this is practically never perfect, but in a great many cases some recovery of sensation returns, and this of itself is of great advantage to the individual, protecting him from burns and other injuries, and also indirectly leading to an increase of nutritional activity.

FIVE CASES OF RAT-BITE FEVER:

TWO CASES TREATED SUCCESSFULLY BY
NOVARSENOBILLON.

BY

F. W. BURTON-FANNING, M.D.CAMB., F.R.C.P.,
HONORARY PHYSICIAN TO THE NORFOLK AND NORWICH HOSPITAL.

JUDGING from my experience, I am inclined to think that this remarkable disease is not so rare as is generally supposed. It has been well recognized in Japan since 1899, and some 40 cases have been recorded there. But it was not until 1910 that Sir T. J. Horder¹ published an account of three cases of rat-bite fever, stating that they were "instances of a disease hitherto undescribed, at least in this country." Since then single cases have been recorded by Dr. G. S. Middleton,² by Dr. R. W. Cruickshank,³ by Dr. J. O'Carroll,⁴ by Professor R. Tanner Hewlett and Dr. G. H. Rodman,⁵ by Dr. F. Nicholson,⁶ and by Dr. J. H. Nixon.⁷ Dr. A. G. Atkinson⁸ had one case under his own observation, and collected the particulars of 5 other cases, which he published for the first time, together with an excellent account of what is known about this disease.

Since 1897 I have seen five patients suffering from rat-bite fever, all of whom came from different parts of Norfolk. In addition, I have been told of a few other cases, some of which at least were probably instances of the same disease.

Three of my patients were in the Norfolk and Norwich Hospital, one was seen with Dr. G. Calthrop in the Wells Cottage Hospital, and the fifth was seen in consultation with Dr. W. Royden, of Flegg Burgh. The cardinal features of the disease were present in all my cases, and are so characteristic that if the existence of such a malady is known its diagnosis is easy. There are also a number of less constant symptoms; these are set out by Dr. Atkinson, and I propose only to refer to some of them and to give briefly the notes of three of my cases. The mortality of rat-bite fever in Japan is stated to be 10 per cent.

The fifteen published cases in Great Britain and my own five cases all eventually recovered. It has been noted as one of the features of the malady, as seen in this country, that there is a tendency to its spontaneous subsidence, but its course may be a very long one and the patients are usually gravely ill. In different cases the duration has varied between a few months and as many years. Until recently it was agreed that no treatment was of any avail. The periodic attacks of fever have led to the trial of large doses of quinine, but this and a number of other drugs—