ON
NERVE STRETCHING AND SPLITTING
IN
LOCALISED INTERSTITIAL NEURITIS, LEPROUS
AND OTHERWISE.

BY
KENNETH McLEOD, M.D., LL.D.

Received November 14th, 1893—Read February 13th, 1894.

In the year 1877, after witnessing in Edinburgh the brilliant results obtained by stretching the great sciatic nerve in cases of sciatica which had resisted all other methods of treatment, and in which grave disturbance of sensibility and serious impairment of movement had existed, I recommended¹ the employment of the same expedient in cases of anæsthetic leprosy. The success achieved in sciatica was attributed by Mr. Chiene to the liberation of the axis cylinders of nerves from the destructive pressure caused by the products of chronic interstitial inflammation. The researches of Dr. Vandyke Carter had shown that the nervous lesion in anæsthetic leprosy is of a similar character; and it appeared to me, presuming

¹ 'Indian Medical Gazette' for July, 1877, p. 190.

that the explanation of the *modus operandi* of the cure in sciatica was sound, and the pathology of the anæsthesia, atrophy, paralysis, and trophic changes in leprosy correct, that the operation was likely to be followed by relief, if not cure, in such cases. My suggestion was soon put to the test by Dr. Edward Lawrie, who at that time held the office of resident surgeon in the Calcutta Medical College Hospital. Dr. Lawrie reported¹ that he had performed the operation of stretching in thirty cases of ulnar neuritis causing anæsthesia and motor and trophic disturbances. The nature and causation of the lesion was not specified, but it was stated that in every case the operation was followed by benefit likely to be permanent. These cases were treated at the surgical outdoor dispensary of the hospital, and it was remarked that the patients ceased to attend "when the relief they experienced seemed to them decisive." In two cases in which an opportunity was found of watching their after-history, the relief was found to be permanent.

Dr. Edward Downes, a medical missionary practising in Kashmir, where leprosy is very common, put the operation to trial in a considerable number of cases. On the 20th of May, 1886, he read a paper at the Harveian Society of London² giving the results of his experience. He had performed the operation of stretching in forty-two instances; thirty-two were well-marked cases of leprosy. He selected the sciatic nerve as the subject of his operations, and the conditions for which he operated were,—anæsthesia of the lower extremities, loss of pigment, tubercles, neuralgia, and ulceration. The duration of the disease in his cases was from one to seven years. "All the cases," he writes, "were benefited by the operation, and in some the ulcers healed completely, and sensation was nearly restored to its normal state. The latter generally took place in the first few days." The success was appreciated by patients,

¹ In the 'Indian Medical Gazette' for September, 1878, p. 229.

² See 'Lancet,' vol. i of 1886, p. 1070.

who brought their friends to be operated on. In one case he found that the sensation of the limb continued good for two years ; but the great majority of his cases, as is usual in India, were lost sight of. Dr. Downes's successor, Dr. Arthur Neve, writing to the 'Lancet'¹ stated that he occasionally met with cases which had been operated on by Dr. Downes six or seven years previously. Many continued to have good sensation ; others returned to have the operation repeated ; in a large proportion of cases he found the benefit to be permanent, and in very few indeed was the recurrence rapid or complete. Dr. Neve, on succeeding Dr. Downes in the charge of the Kashmir Medical Mission, continued to practise nerve-stretching in cases of anæsthetic leprosy. In the 'Edinburgh Medical Journal' for November, 1884, he gives a record of 190 operations performed on ninety persons. "In no disease," he remarks, "has nerve-stretching been practised with such uniform success." In eighty-four of the ninety cases improvement and recovery of sensation were noted, in two no improvement occurred, and four died of other causes. He notes that the area of anæsthesia is generally surrounded by a ring or halo of hyperæsthesia, betokening advancing and progressive disease ; that the nerves of the trunk are seldom affected ; and that the lesions of sensation, motion, and nutrition are generally confined to a definite area corresponding to the distribution of a particular nerve. In seventy-one cases the sciatic nerve was implicated, in seven the ulnar, in five the median, and in two the musculo-spiral. He found that improvement became manifest in from two to five days, that the restoration of sensation took place centrifugally, and that restoration, complete or incomplete, occupied a period of three weeks. At the same time the nutrition of the affected area improved, ulcers healed, and tubercles disappeared. In two cases the opposite limb improved but in a lesser degree. In no case did any detrimental effect ensue, and he observed that the best stretched cases

¹ Of 14th August, 1886, p. 325.

showed most improvement. Two cases returned after about four months with a recurrence of anæsthesia; in one of these the operation was repeated with benefit. Recurrence was, however, a rare experience; and in many cases which remained under observation for a year or longer, improvement of sensation and nutrition was found to be permanent and progressive. In two cases the ulnar nerve gave way under traction, but in a few days sensation was restored notwithstanding. No local inflammation or suppuration occurred in any case, and normal sensation was recovered in 75 per cent. of the cases.

The operation was sought after by lepers in Kashmir.

I have myself performed the operation of nerve-stretching in many cases of a similar nature, and with corresponding results; and successful cases have also been recorded by Dr. Wallace of Calcutta, Dr. Mitra of Kashmir, Assistant Surgeon Mahendra, Nath. Ohdedar of Srinagar in Garhwal, and others.¹ Indeed, it is evident from dispensary statistics that nerve-stretching has become an established operation in India.

Dr. Beaven Rake of Trinidad has recorded² the results of 100 operations of nerve-stretching performed on sixty cases of leprosy. In twenty-six cases the nerve stretched was the sciatic; in eleven, the external popliteal; in forty, the median; in eighteen, the ulnar at the elbow; in four, the same nerve at the wrist; and in one, the supra-orbital. Ulceration was the condition for cure of which stretching was mostly resorted to. As a rule, it is stated, more or less good was obtained. Relief of pain was one of the most satisfactory results. He does not seem to have been as successful in restoring sensibility as Indian operators, but his cases were evidently of a more advanced and aggravated character, in which the trophic disturbance had reached the destructive stage. More or less relief was obtained in forty-seven out of the 100

¹ See appended cases.

² In the 'British Medical Journal' of 22nd December, 1888, p. 1373.

operations. The nerve was found to be enlarged in forty-eight instances—principally the median ulnar and external popliteal. In some cases which died of other causes the nerve was examined at the seat of operation. No naked-eye change was seen, nor any adhesions to surrounding parts observed.

Such is a summary of all the evidence which I have been able to collect on the subject of nerve-stretching in leprosy. The operation of *nerve-splitting* was first resorted to by me in the year 1880 in a case which I fully reported in the April number of 'Brain' for that year, a short abstract of which is appended.¹ An East Indian youth, twenty-six years of age, had suffered for eight years from ulnar neuritis, which had resulted in an abscess leaving behind it a sinus occupying the interior of the indurated and thickened nerve. All the characteristic results—sensory, motor, and trophic—of grave disease of the nerve were present in an aggravated degree. I slit up the sinus, which was about four inches long, scraped the interior of it, divided the indurated nerve in two longitudinally, carefully stretched it in addition, and closed the wound, which healed kindly. Improvement in sensation and power commenced in a few days, and continued to progress. I had opportunities of seeing this case from time to time for about ten years, and found on the last occasion that the limb had been restored almost to a normal condition. I have collected eight other cases (six of my own, one by Dr. Bomford, and one by Dr. Tomes)² in which the operation of longitudinal splitting was resorted to for localised neuritis with distal impairment of sensation, motion, and nutrition. In two of the cases speedy and signal benefit resulted; in four decided relief was obtained; and in two cases of anæsthetic leprosy in which the neuritis was multiple no improvement took place. I regret that the induction as regards splitting diseased nerves is so limited; but as I shall

¹ No. 1 of Cases of Nerve-splitting.

² See Appendix.

have no further opportunity of putting the operation to the test, I have thought it right to represent the matter to the profession as it now stands, in order that further trial may be made by others of nerve splitting in suitable cases.

There are several circumstances connected with the peripheral neuritis of the leprosy which appear to me to justify recourse to local measures.

1. The inflammation is, as Dr. Gowers states, "typically interstitial," involving the primary sheath of the nerve and the secondary sheaths of the fasciculi and extending into the interior of the latter among the nerve fibres, which undergo a slow process of degeneration and atrophy from pressure and tension. This process of destruction is progressive, and may continue until the whole of the nerve-fibres composing a fasciculus disappears, and their place is taken by the organised products of the connective tissue inflammation.

2. The neuritis is a focal lesion, being limited to one or a few nerves, and to one or a few points in its or their course. It is a distinctly localised lesion, apt to be multiple; but the less so the more favorable for local treatment. Not only so, but the morbid process seldom, if ever, involves the whole thickness of the nerve. The patchy character of the cutaneous lesion, at any rate in the earlier stages of the malady, indicates this fact, which has also been established by microscopic observation. Dr. Vandyke Carter has clearly shown that the disease may implicate a single fasciculus only or only the sensory or the motor parts of a compound nerve. "During my examination of leprosy nerve-strands," he states ("On Leprosy and Elephantiasis," 1874, p. 52), "no fact impressed me more than that of the limited district of deposit amongst the nerve-tubes; generally those at the circumference, near the perineurium, were most implicated."

3. The lesion occurs only in superficial nerves, and generally at particular places—where they pierce the deep

fascia, or are close to joints undergoing frequent and extensive movements. The ulnar nerve above the bend of the elbow is one of the most frequently and earliest involved, very often the only one; and it would seem as if the mechanical disturbance due to position, which in health is tolerated, serves, when a proclivity to disease arises, to determine localisation.

4. The inflammatory products undergo similar changes to those which occur in a common inflammation. At first fluid and corpuscular, they in time present the more advanced forms of spindles and fibres; the material consisting in the end of cicatricial tissue, the contractile properties of which are so well known. The affected nerve undergoes changes accordant with these pathological events. At first hyperæmic, swollen, soft, or gelatinous, it eventually becomes firm, hard, anæmiated, or even sclerosed. Increase of size is manifest throughout, but in time the distal part of the nerve undergoes atrophy.

5. Evidence of partial resolution of the morbid process exists. The liquid part of the product may be removed by absorption, and the corpuscular by degeneration; but the latter is prone to undergo progressive organisation. The fact that the bacillus of leprosy is found abundantly in the recent disease, and disappears altogether as the product organises, further indicates that there is a tendency to limitation of the disease in time, or even that a curative or restorative effort arises. Why the resolution is imperfect, and such a strong tendency to organisation exists, is probably due to persisting irritation as in cases of cirrhosis of the viscera. No proof has been as yet adduced of any reproduction of nerve-tubules or endeavours thereto.

6. Evidence of the existence of pressure and tension in the diseased part is furnished by the way in which, on dividing a leprous nerve post mortem, the fasciculi, as shown by Carter, start out of the sheath and stand apart from each other firm and separate; still better by the

gaping which the wound caused by longitudinal splitting of nerves in the living is seen to undergo.

The degeneration and destruction of the nerve-fibres is evidently a pressure effect, and not, except in the immediate neighbourhood of tubercles and ulcers, a parenchymatous process.

7. This process of degeneration and destruction is a slow, and slowly but surely progressive one. The intensity of the effect-lesion is progressive. There is first, as regards sensation of the distal parts, hyperæsthesia, increased tenderness and tingling pain ; then numbness and formication, and finally complete anæsthesia : as regards motion, there is first impairment and stiffness, then abolition, then muscular wasting ; and, finally, firm contraction of tendons and immobility of joints : and, as regards nutrition, there is first hyperæmia, effusion, thickening, and change of colour ; then glazing, or desquamation, or eruption—papular, eczematous, pustular, or bullous ; and, finally, ulceration, atrophy, necrosis, or even gangrene. The area of the lesion gradually extends, and the extension is invariably from periphery to centre. The time comes when, as shown by Dr. Buzzard, the nerve, or a great part of it, loses its nervous elements and becomes converted into a mass of cicatricial tissue. Then it is that the distal portion of it shrinks, and the effects of the destructive process become confirmed and irremediable.

These circumstances give ample and additional countenance to any operative proceeding which may enable the tubules to escape destructive pressure, assist the lesion in undergoing resolution after the crisis of the local disease has passed over, and perhaps permit of salutary restorative as well as recuperative events to occur.

The cardinal objection to operative interference in leprosy is that the disease is of a constitutional character, and that local measures are but palliative and do not in any appreciable manner, or to any material extent, stay the deathward progress of the malady. The truth of this contention cannot be denied ; but the symptoms and

effects of these nerve-lesions are a source of pain and distress, and the evidence which I have adduced makes it abundantly clear that by stretching and splitting nerves affected with leprous inflammation, pain may be relieved, feeling restored, muscular power improved, eruptions cured, ulcers healed, and the process of destruction of the distal parts of the limbs mitigated and delayed. If these benefits can be obtained by operative proceedings which are perfectly simple and harmless, an extremely strong case for their adoption has been established, and the only question that remains is,—under what circumstances, as regards the duration of the disease and of the lesion, and the ascertained or presumed condition of the nerve, the operation of stretching or splitting, or of stretching and splitting combined, may with propriety and promise of success be resorted to. But there are numerous cases, met with more frequently in the tropics, but by no means unknown in Europe and America, as testified by medical literature, in which the surface nerves of the body undergo local inflammatory changes resembling those of leprosy, and entailing consequences as regards sensation, motion, and nutrition, similar to those seen in anæsthetic leprosy. The nerve-lesion may be of traumatic, constitutional, toxic, or miasmatic origin; but whatever the causation, the distal effects are the same. The ulnar nerve is very specially liable from injury or participation in surrounding or neighbouring disease to undergo a process of thickening and induration above the internal condyle of the humerus, and when this condition does not disappear by resolution, the characteristic effects on the sensation, movements, shape, attitude, and nutrition of the forearm and hand are certain to arise, in consequence of pressure effects on the nerve tubules. Cases of non-leprous ulnar neuritis are by no means uncommon, and many of the most brilliant results of stretching and splitting which have been placed on record have been obtained in cases of this kind. In these the arguments which discourage operation in the leprous have no force; and when mea-

asures such as rest, repeated blistering, galvanism, administration of arsenic and the iodides, &c., have been resorted to without success, and the distal effects are becoming progressively more grave and extending, the question of operation does not, I would urge, admit of doubt or delay.

Whether that operation shall be stretching or splitting or both combined, will, I venture to say, depend on the state of the nerve. If the nerve is found on exposure to be pearly, hard, anæmic, and resistant, I strongly advise a longitudinal incision throughout the whole extent of the diseased part to a depth of one third or one half of its thickness according to circumstances, and a subsequent careful and prolonged but gentle manipulation and stretching of the trunk. There are conditions of nerves in which an accumulation of the liquid products of inflammation takes place beneath the perineurium. A very striking instance of this kind involving the sciatic nerve has been placed on record by Sir Joseph Fayrer in 1868, in which immediate and permanent relief was obtained by incision, and evacuation of about half an ounce of fluid ('Medical Times and Gazette,' vol. i for 1868, p. 8), and he informs me that he has since met with other cases of the same sort. The motive to operate in such cases is different from that which I have endeavoured to impress in this paper; but the relief of pain, numbness, and crippling which was so promptly afforded by incision was undoubtedly due to the removal of pressure and tension; and the signal benefit often conferred by the use of acupuncture in sciatica is doubtless due to the same cause.

From the facts and considerations which I have advanced the following conclusions are, I think, fairly deducible.

1. The operation of nerve-stretching has been followed by decided relief in a large proportion of cases of leprous neuritis which have been subjected to this method of treatment.

2. The benefits conferred have consisted in the relief of suffering—pain, tingling, &c.—the restoration of sensibility, the return of muscular power, the healing of ulcers, and general improvement in the nutrition of the affected parts. These benefits have speedily followed on the operation, and in a considerable proportion of cases have been sustained and progressive. In many instances repetition of the operation has been attended with success.

3. Additional knowledge is desirable regarding the precise conditions under which recourse to the operation is likely to be advantageous, more especially with reference to the limitation of the local lesion and the stage of the malady.

4. The relief obtained by this proceeding appears to depend on the removal of pressure and tension exercised on nerve-fibres by the products of the inflammatory disease which has taken place in the ensheathing connective tissue of the trunk.

5. When these products have undergone organisation, and the enveloping material has become sclerosed, longitudinal incision of the sheath, followed by manipulation and stretching, give reasonable promise of more complete relief—resolution or even restoration—than stretching alone.

6. This process of splitting sclerosed nerve trunks has been attended with success in a sufficient number of cases to render further trial justifiable or desirable.

7. In cases of non-leprous localised neuritis, these procedures are more likely to be followed by radical and permanent benefit than in cases of anæsthetic leprosy.

8. In no instance has either the stretching or splitting of nerves been productive of any inconvenience or harm.

APPENDIX.

CASES OF NERVE STRETCHING.

CASE 1. *Ulnar neuritis; thickening, anæsthesia, paresis; stretching; recovery.*—Hindu male, æt. 40, coolie. Anæ-

thesia with tingling and pain, of one year's duration, over ulnar area of right hand, the power of which was greatly diminished; skin thickened; ulnar nerve thickened above inner condyle. Nerve stretched. Thirty-six days afterwards, skin healthy, sensation perfect, thickening of nerve gone; tingling and pain disappeared; hand stronger. (Lawrie, July, 1878, 'Indian Med. Gaz.,' p. 229.)

CASE 2. *Ulnar neuritis; tingling pain, anæsthesia, and paresis; stretching; perfect recovery.*—European female. Pain, tingling, loss of sensation of left ulnar area; four months' duration; skin discoloured "dull red;" muscles wasted; ulnar nerve thickened and stretched. Two days afterwards pain disappeared, and tingling lost in four days; sensation partially restored. Six months afterwards nerve normal in size, and "functions perfect." No trace of disease existed in any part of the hand, forearm, or arm. Seen by Wallace four years afterwards, "success complete." (Lawrie, October, 1878, 'Indian Med. Gaz.,' p. 270.)

CASE 3. *Ulnar neuritis; anæsthesia; paresis; stretching; recovery.*—Hindu male, æt. 45. Had an attack of malarial fever six months ago, during which after a period of tingling the left hand and forearm became anæsthetic except the thumb, forefinger, and half of middle finger. Pustular eruption and blebs appeared over anæsthetic area, and muscles became thin and wasted. Anæsthetic patches existed on dorsum of right hand and left cheek. No history of syphilis or injury. Ulnar nerve above elbow thickened and tender; fingers flexed. Nerve exposed above elbow and thoroughly stretched. In two days sensation began to return. A small abscess formed in the neighbourhood of the wound, and the limb became œdematous; the abscess was opened and the œdema subsided. At the time of his discharge, twenty-three days after operation, sensibility had been restored everywhere except in the little finger and thumb, where it

remained dull. Muscular power was much improved, and the flexion of the fingers disappeared. He was not seen again after he left the hospital. (McLeod, 1879, 'Indian Med. Gaz.,' p. 229.)

CASE 4. *Ulnar neuritis ; anæsthesia, &c. ; stretching ; recovery.*—Hindu male, æt. 25. Anæsthesia of left ulnar area in patches ; stiffness of fingers and periosteal thickening of phalanges and metacarpals. Nerve thickened above elbow. Symptoms commenced a year ago with tingling and pain in nerve coincident with ague. A papular eruption occurred, and the skin was thickened and discoloured. Nerve stretched ; it had an indurated pearly appearance. Sensation began to return on second day. Improvement progressive ; thirty-six days afterwards sensory, motor, and nutritional function of nerve completely restored ; twenty-four days later improvement sustained, likely to be permanent. (Wallace, 'Indian Med. Gaz.,' November, 1880, p. 300.)

CASE 5. *Ulnar neuritis ; anæsthesia ; &c. ; stretching ; recovery.*—Hindu male, æt. 35, coolie. Numbness, preceded by pain and tingling of left forearm and hand ; wasting and paralysis of muscles ; loss of pigment in patches ; symptoms of one year's duration. History of ague ; none of syphilis or rheumatism. Ulnar nerve stretched above elbow. Nerve decreased in size ; operation followed by pain. Sensation began to return in three days, completely restored in five days, power returning. Improvement progressive. In six weeks sensation and motion had been perfectly restored. (Wallace, 'Indian Med. Gaz.,' November, 1880, p. 300.)

CASE 6. *Anæsthetic leprosy ; both ulnar and sciatic nerves stretched ; marked improvement.*—Hindu male, æt. 30. Anæsthetic patches on trunk and limbs, specially marked in ulnar areas and on legs and dorsal surfaces of feet. Hands wasted ; muscular power much impaired.

Both ulnar and both sciatic nerves stretched ; all thickened ; right ulnar softened ; left sciatic adherent to fascia. Improved rapidly after operation ; regained power of hands ; sensibility restored everywhere, though not fully. Remained in hospital thirteen days. (Lawrie, 'Lancet,' March 12th, 1881, p. 413.)

CASE 7. *Anæsthetic leprosy ; ulceration ; right sciatic nerve stretched ; ulcers healed and sensation partially restored.*—Hindu female, æt. 40. Anæsthetic leprosy of six or seven years' duration ; right leg and foot affected ; gangrenous ulcers on toes. Sciatic nerve stretched. Wound healed in a week. Ulcers healed, and sensation was restored to a slight extent. (McLeod, 'Indian Med. Gaz.,' June, 1881, p. 158.)

CASE 8. *Ulnar neuritis ; anæsthesia, &c. ; stretching ; recovery.*—Hindu male, æt. 40. Anæsthesia of ulnar area of both hands, papular eruption on both sides ; loss of sensation in left leg and foot. Right ulnar nerve stretched above elbow ; nerve much thickened, nearly four times its natural size. Sensation began to return in two days, and was completely restored in five days. Papular eruption disappeared. (M. U. Ohdedar, 'Indian Med. Gaz.,' August, 1882, p. 213.)

CASE 9. *Anæsthesia and ulcer of left foot ; thickening of popliteal and musculo-cutaneous nerves ; stretching ; recovery.*—Hindu male, æt. 40. Toes of left foot became anæsthetic a year ago, and ten months ago sustained wound of sole of same foot which has remained open as a sloughy ulcer. External popliteal and musculo-cutaneous nerves thickened. Anæsthesia involves dorsum of foot, anterior third of sole, and anterior aspect of leg ; skin thickened and dusky. These two nerves were exposed and stretched. Sensation was restored, the ulcer rapidly cicatrised and the skin regained its normal aspect and condition. (McLeod, 'Indian Med. Gaz.,' October, 1891, p. 307.)

CASES OF NERVE SPLITTING.

CASE 1. *Ulnar neuritis ; splitting and stretching of nerve ; marked and sustained improvement.*—East Indian male, æt. 26. Numbness and wasting of left forearm and hand of eight years' duration ; sinus above left elbow, result of abscess four years previously. Muscles supplied by ulnar nerve much wasted ; griffin hand ; sensation diminished or abolished over area of distribution of ulnar nerve up to wrist. Skin congested and thickened ; ulnar nerve thickened and hard. Sinus laid open, found to occupy interior of nerve and contain curdy matter, about four inches in length ; material scraped out of cavity and out of smaller cavities in the nerve communicating with it. Nerve split in two and thoroughly stretched. Wound healed soundly. Twenty-four days afterwards muscular power and sensation much improved. Fourteen months after this, sensation entirely restored ; muscles had regained bulk and power ; hand stronger ; fingers less bent ; ulnar nerves thinner and softer. Seen again ten years afterwards ; general health good ; sensation undiminished and muscular power much improved ; hand almost normal. (McLeod, 'Brain,' April, 1880.)

CASE 2. *Double ulnar neuritis ; anæsthesia ; wasting and paresis ; stretching and splitting of right ulnar, and rupture and suture of left ulnar ; recovery.*—Hindu, male, æt. 40. Complete anæsthesia of ulnar areas. Muscular wasting and loss of power. Condition worse on left side. Both ulnar nerves thickened above the elbow. Right nerve thoroughly stretched and incised longitudinally. Left nerve nodulated and adherent ; broke under traction ; ends freed and sutured with catgut. Sensation completely restored on right side, and power returned rapidly. On left sensation began to return two days after operation, and continued to improve until it was re-established in eleven days. Muscular power recovered to a great extent. Returned to work as a road labourer, and

reported well three and a half months after operation. (Bomford, 'Lancet,' February 25th, 1881, p. 329.)

CASE 3. *Anæsthetic leprosy of five years' duration ; splitting of left ulnar and stretching of musculo-spiral nerves ; no improvement.*—East Indian male, æt. 17. Painful thickening of left ulnar nerve and tuberculated patch of anæsthetic skin on dorsum of wrist and lower part of forearm ; commenced with itching of skin five years ago ; fingers not affected. Similar patch over right tendo Achillis. General health good. Thickened nerve exposed above inner condyle, split to extent of four inches, and pulled. Sheath found much thickened. Wound of nerve gaped. Operation performed antiseptically on 18th April ; healed on 25th November. No benefit. Musculo-spiral exposed above outer condyle and stretched on 28th ; wound healed by first intention. Operation followed by wrist drop, which gradually disappeared. No improvement as regards anæsthetic patch ; would not have internal cutaneous stretched. (McLeod, 'Indian Med. Gaz.,' June, 1881, p. 158.)

CASE 4. *Left ulnar neuritis ; hyperæsthesia ; splitting and stretching ; relief.*—Mahomedan, æt. 52. Two painful patches of thickened skin on wrist and ulnar side of left forearm. Disease of two months' duration. Ulnar nerve split for four inches above condyle and pulled. Sheath pearly in colour and thickened. Hyperæsthesia relieved ; thickening of skin reduced somewhat. Wound healed in eleven days ; performed antiseptically ; catgut drain used. (McLeod, 'Indian Med. Gaz.,' June, 1881, p. 158.)

CASE 5. *Left ulnar neuritis ; anæsthesia and skin disease ; splitting and stretching ; improvement.*—Hindu, æt. 29. Ulnar side of left forearm and little finger anæsthetic ; skin thickened. Similar patch on left leg above outer malleolus. History of secondary syphilis six

years ago. Disease of five months' duration; became glazed, red, and discoloured one month ago. Ulnar nerve above elbow much thickened. Nerve split and stretched for about five inches; sheath thick and pearly. Operation performed antiseptically; catgut drain used. Wound healed in twelve days. Thickening of skin gradually disappeared; sensation restored to a slight extent. (McLeod, 'Indian Med. Gaz.,' June, 1881, p. 158.)

CASE 6. *Right ulnar neuritis; anæsthesia; history of syphilis and injury. Nerve split and stretched; decided improvement.*—Hindu male, æt. 25. Suffered from syphilis twelve years ago. Got a severe injury of the dorsum of the right hand two years ago, followed by inflammatory swelling and gradual loss of sensation over the inner side of the hand. The ulnar nerve is indurated and thickened above the elbow. The musculo-spiral nerve is also felt to be thickened as it winds round the humerus. There is loss of sensation over the little and ring fingers, as well as over the palm and dorsum of the ulnar side of the hand. Complains of tingling over the inner side of the forearm. There is no eruption or ulcer. There is considerable atrophy of the muscles of the forearm, also of those of the little finger. The little finger is flexed, and the ring finger partially so. The ulnar nerve was exposed to the extent of four inches above the elbow. The coat of it was found to be congested and sclerosed. It was carefully split in the direction of its long axis to the full extent of the wound; it was also stretched. Patient remained in hospital seventeen days. The tingling disappeared; sensation was restored in some measure, and the fingers became more flexible. (McLeod, 'Indian Med. Gaz.,' September, 1887, p. 264.)

CASE 7. *Anæsthetic leprosy; multiple neuritis; anæsthetic atrophy; splitting and stretching of ulnar, musculo-spiral, and median nerves; no improvement.*—Jew, æt. 14. Anæsthetic leprosy. Left ulnar, musculo-spiral, and

median nerves much thickened, and the parts supplied by them quite anæsthetic and wasted. The thickened nerves were exposed, freely split in the direction of their axis, and then stretched. The wounds healed by first intention, but no benefit was conferred by the operation. (McLeod, 'Indian Med. Gaz.,' August, 1888, p. 239.)

CASE 8. *Ulnar neuritis, traumatic; anæsthesia, &c.; splitting and stretching; sensation restored.*—Mahomedan male, æt. 45, sustained an injury of right wrist twelve months ago. Six months later the inner side of that hand became the seat of tingling, and that was succeeded by numbness, wasting, and loss of power of muscles, and disease of the skin. Thickening and induration of the ulnar nerve were discovered. The diseased portion was split longitudinally into two and the nerve stretched. Sensation returned in the anæsthetic parts shortly after the operation. Ultimate result unrecorded. (Tomes, 'Indian Med. Gaz.,' August, 1890, p. 244.)

CASE 9. *Neuritis of median nerve; anæsthesia; paralysis, ulceration of finger tips; splitting; recovery.*—In this case the enlargement of the median nerves was above the annular ligament. It was fusiform in shape, and very hard. The benefit conferred by splitting this portion of the nerve was early and undoubted. (McLeod, 'Indian Med. Gaz.,' October, 1891, p. 307.)

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' Third Series, vol. vi, p. 53.)