Observations

ON THE

TREATMENT OF TRIGEMINAL NEURALGIA

ALCOHOL INJECTION OR OPERATION

BY

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It is now some twenty years since my first papers on this subject were published. In this interval my experience of many hundreds of cases has confirmed my view of the advantages which successful Gasserian injection has over any open Gasserian operation. I wish to emphasize this statement in view of the opinions that were expressed by surgeons at the discussion at the British Medical Association Meeting last July.

In a major operation, such as the Gasserian, there is always a possible risk of death, either from the anaesthetic, or from shock, embolism, or even from haemorrhage. Again, a certain amount of cerebral compression must occur during the process of brain retraction while the Gasserian root is being searched for, and I have seen such compression followed directly by hemiplegia, by aphasia, and by complete change of character in different cases operated on by front-rank neurological surgeons.

Mr. Jefferson referred to Hutchinson's modified ganglion operation as having "the extremely low mortality of 4 per cent." and to his own series of eighty-five cases with two deaths. This is far too high a mortality, and confirms my contention that ganglion injection, properly performed, is preferable. Mr. Jefferson further offered the opinion that alcohol injection of the ganglion "should be restricted to those who are judged to be physically incapable by reason of their age or of coexisting disease to undergo operation." I am, of course, unaware on what experience of injection of the ganglion this statement rests, as no facts or statistics were given, but the object of my paper is to demonstrate my reasons for considering the matter from the reverse point of view—namely, that no patient suffering from trigeminal neuralgia should undergo the open operation until it has been shown that a satisfactory injection of the ganglion cannot be performed.

First, the comparative risk to life. Since the modern methods of section of the posterior root have displaced the older resection of the ganglion itself, the danger to life from haemorrhage has undoubtedly decreased, and in the hands of an expert surgeon who has already performed this operation hundreds of times, the mortality may fall, as in Frazier's series, to 0.37 per cent. Even then, there is one death in 269 cases which would not occur if alcohol injection could be performed instead. Such a small percentage of fatalities might possibly be forgiven if it applied to all operations by this method, but it must be remembered that the surgeon has to perfect his technique at the expense of his patients, and that the risk to life is the price the patients pay for his skill.

Mr. Jefferson himself admits to two deaths in eighty-five cases, more than six times the mortality which he quotes as the present ideal. How much greater, therefore, is the risk of death likely to be for a patient in the first dozen cases that a surgeon undertakes; and is every surgeon who may be encouraged to attempt this operation likely to be as carefully trained in the technique of the operation as Mr. Jefferson? In his own words, "the operation of section of the sensory root is a very difficult operation to learn, and is at times an exceedingly difficult operation to perform." The obvious retort that might be made to me, as an advocate of alcohol injection, is

that we too have to develop our experience and technique at the expense of our patients; but this is at no risk to life. The balance of risk is therefore obviously heavily against the open operation.

Secondly, loss of time, and nursing home and other expenses. Ten days to a fortnight is likely to be the minimum stay in home or hospital after the open operation, and the expenses are obviously very much greater for a private case. Rarely, moreover, will a patient be fit for work immediately on leaving hospital, and another fortnight will probably be spent in convalescence. With the injection method, one or two days is all that is necessary if carried out under morphine-scopolamine anaesthesia in hospital or nursing home; with local novocain anaesthesia only, I have injected the Gasserian ganglion in dozens of cases in my consulting room, and the patient is able to walk away perfectly fit and well, even with total trigeminal anaesthesia, requiring perhaps only a shade to be worn over the eye on that side for three or four weeks.

Just as experience and perfection of technique are necessary for the modern fractional root section for trigeminal neuralgia, so are they necessary for success in injections of the ganglion. Careful study of numerous skulls in the museum is an essential in the training of an expert in injection; he must also practise actual injection on the cadaver in the post-mortem room, using a coloured fluid, which he can trace after removal of the calvaria and brain. Not until he is familiar with this procedure should he presume to attempt an injection for a patient. It is the lack of experience and of careful study of the anatomy, and the attempts of physicians (and surgeons) to inject the foramen ovale, or rotundum, quickly under deep anaesthesia, that are largely responsible for most of the strictures which have been passed upon the injection treatment.

CHOICE OF AN ANAESTHETIC

In my opinion inhalation anaesthesia should very rarely be used for the injection treatment. It is an unnecessary risk in itself, and is quite unsuitable for a scientific injection of the nerve trunk or of the ganglion, inasmuch as no tests as to the degree of cutaneous anaesthesia obtained (if any) can be made until the patient is allowed to come round from the anaesthetic. If it is then found that no anaesthesia of the nerve to be injected has been obtained, then more ether or chloroform has to be administered, and vomiting generally results.

By far the most satisfactory method of inducing partial general anaesthesia, in order to perform the injection painlessly, is to administer morphine-scopolamine hypodermically about three-quarters of an hour before, and leave the patient, with blinds drawn, to become drowsy. Usually 1/4 grain of morphine and 1/150 grain hyoscine hydrobromide suffice, but with patients of 65 and upwards, who are not accustomed to morphine, often 1/8 grain is sufficient. By this method the patient is still semi-conscious, and can answer tests to pinprick during the progress of the injection, a most necessary guide to the correct finding of the nerve by the needle, and for deciding the amount of alcohol to be injected after the nerve has been found.

Some patients may require a second dose of morphine and hyoscine before they become suitably drowsy, especially if morphine has been used in the treatment of the neuralgia. In that case I inject another dose of 1/8 grain or 1/4 grain of morphine, according to the conditions, with 1/150 grain of hyoscine, and wait another twenty minutes before commencing the injection. This entails a certain amount of patience, but care and patience are essential for good results in alcohol injections, and more particularly when the Gasserian ganglion is the

objective. The surgeon or physician who quickly pushes his needle to the base of the skull, under deep anaesthesia, and then injects 15 or 20 minims of alcohol, saying he has injected the foramen ovale, is deluding himself nineteen times out of twenty, as is proved in so many cases by the absence of any cutaneous anaesthesia afterwards. Very occasionally he may by good luck strike the foramen, and if he then injects such a quantity of alcohol through the foramen it is very likely to burst through into the lateral recess and cause serious cranial nerve paralysis, as I have known occur more than once. No one can be certain, by the feel of the needle against the base of the skull, when the point engages the foramen ovale. It may be thought that the needle has hit the foramen, and very possibly that may turn out to be correct, but much more often it is otherwise, and the needle has to be readjusted perhaps several times before the foramen is definitely found. Therefore I say most emphatically that alcohol injection to the deep foramina under complete general anaesthesia is an uncertain and unscientific method. Long experience has convinced me that the only correct method is to use either local novocain anaesthesia, as a preliminary to the alcohol, or local novocain combined with morphine-scopolamine partial general anaesthesia. By this means the patient is able to indicate when the nerve is reached, and injection then of a few drops of 2 per cent. novocain proves within half a minute whether the point of the needle is within the nerve or not by the resultant cutaneous anaesthesia quickly appearing on lower lip, chin, and half of the tongue. This is practically a painless method, and alcohol is then injected to complete the destruction of the nerve which has been anaesthetized by the novocain.

With ether or chloroform inhalation anaesthesia one always feels a little hurried, and the use of the mask on the face and the position of the anaesthetist interfere with the free manipulation of the needle that is required. With morphine-scopolamine anaesthesia the greatest deliberation of movement is easy; vomiting never occurs during the operation, though this complication is common with an inhalation anaesthetic, when the patient is allowed to come round for testing purposes. If the proper amount of morphine and hyoscine is used, and sufficient time allowed, its general anaesthetic action is ideal; no pain is felt, and the memory of the operation is afterwards often entirely obliterated, though at the time sufficient consciousness is preserved for fairly reliable answers to be given to tests for anaesthesia to pinprick on the lips, chin, or cheek.

Many patients prefer to have the injection under local novocain only, without general anaesthesia, and it can then be done in the sitting position in a comfortable armchair in the consulting room. For this purpose I have had a special armchair made to my own design by Messrs. Maple, which ensures that the patient's arm, on the side operated on, cannot interfere with the operator. These patients will often admit, if asked, that the pain of the injection is not sufficient to make a general anaesthetic worth while, as it is much less severe than the neuralgic spasms they are constantly suffering. If, however, the patient is nervous, especially if a woman, then a preliminary morphine-hyoscine injection is advisable, but this should be done with the patient in bed, sitting propped up with pillows, not on an operating table. Some persons require more morphine than others to induce the required stage of quiet somnolence, and over the age of 65 I generally use only 1/8 grain, as I find with the larger dose that old people more easily slip into a condition of complete unconsciousness, as if chloroform or ether were used, and then they are totally unable to react to tests, and it is a matter of chance whether the nerve is injected properly.

METHOD OF INJECTION

It is very important to inject the alcohol slowly, not more than two minims at a time, and watch the results, testing the spread of the resultant anaesthesia with a pin before injecting more. Often it will be noticed that, even without passing the needle through the lips of the foramen ovale into the ganglion itself, the anaesthesia is spreading beyond the area of the third division over the cheek, forehead, and eye, indicating infiltration of the whole of the ganglion. Thus, the patient may begin to blink, and if questioned will complain of a sensation of a hair or foreign body in the eye. This always indicates commencing anaesthesia of the eye and cornea. A curious fact commonly observed with such injections of the foramen ovale is that the ophthalmic division of the ganglion becomes anaesthetic earlier and more completely than the second division. To correct this, the needle must be pushed another quarter of an inch through the foramen into the ganglion. Before injecting any more alcohol the needle should then be watched, after removing the stylet, to see if any clear cerebro-spinal fluid drips through it. If this is the case no alcohol must be injected, for the point of the needle is in the cave of Meckel, not in the tissue of the ganglion. The needle must be withdrawn partially and reinserted in a slightly more backward direction. If no clear fluid now drips, then two drops of novocain solution, followed by alcohol, should be injected, and the effect noted.

By this means it is usually possible to destroy the middle portion of the ganglion corresponding to the second division of the nerve. Very often the whole trigeminal area becomes rapidly totally anaesthetic after the first injection of a few drops of alcohol only, and permanent total anaesthesia of all three divisions may occasionally be obtained with as little as five or six minims. More often, after the lapse of five or ten minutes, sensation may return completely over the first and second divisions. This is due to what I call "ganglion shock," and the process may be repeated two or three times with renewed injections of two or three minims, until permanent lasting anaesthesia is produced. A curious feature which I have met with many times, and which is difficult of explanation, is that while the initial injection of a few minims may produce total trigeminal anaesthesia by ganglion shock, yet after the anaesthesia has faded off the first and second divisions after ten minutes or so, the needle remaining stationary, renewed injections may fail entirely to reproduce the anaesthesia of the upper two divisions. This is probably due to faulty position of the needle in the ganglion, as I have often found that readjustment of the needle has led to permanent ganglion anaesthesia.

Although in the majority of cases it is possible to inject the ganglion by the route through the side of the cheek and the sigmoid notch, yet occasionally the mandible is set so high in relation to the floor of the skull that it may be impossible to pass the needle by this route through the lips of the foramen ovale. In such a case, when it is desired to inject the ganglion, and not the third division only, no alcohol should be injected after the third division has been anaesthetized by novocain; the needle should be withdrawn, and when the novocain anaesthesia has passed off a fresh attempt should be made by the anterior route described by Härtel. For this a longer needle is necessary, such as 3½ inch instead of the usual 2½ inch. A point should be taken in the vertical line with the outer canthus, and below the malar bone, the needle being directed backwards, slightly inwards, and upwards. This route gives a steeper line of approach to the foramen ovale, and ensures penetration of the foramen when reached, but I prefer the shorter route when possible, as it is easier and there is less risk of a troublesome haematoma.

Neuralgias limited to the third division alone sometimes remain totally free from all pain for many years after injection of the third division of the fifth nerve only; this is probably due to the alcohol infiltrating the outer portion of the ganglion and destroying permanently some of the neurons of this third portion. Though it is probable that some cases of injection of the third division only at the foramen ovale may remain permanently cured (one lady is still free although it is twenty-three years since I injected her), yet recurrence of the neuralgia may sometimes happen after several years' freedom. I have seen such recurrence after nine, thirteen, and fifteen years in different cases. It is on account of this, especially in second-division neuralgias, that of late years I have been more and more inclined to inject the ganglion in all cases, and thus to try for a permanent cure, rather than risk the probable recurrence of the neuralgia at some future date. During the past twenty-two years since I first injected the Gasserian ganglion for neuralgia, I have treated in this way several hundreds of cases, many of which I know, and a considerable proportion I believe to have been permanent cures, though it is impossible to keep track of large numbers of cases, especially those seen at hospital.

Excluding hospital cases, I have attempted, during the last twelve months, to inject the ganglion in 45 cases in my private practice, apart from other cases of neuralgia in which only the second or third division was intentionally injected; 13 of these 45 resulted in total and apparently permanent anaesthesia of all three divisions. In 8, in which the neuralgia affected the second division, with or without the first, I was able to inject the inner two-thirds of the ganglion, producing

FIG. 1.

total anaesthesia over the upper two divisions of the trigeminal area, but permitting the escape of the third division, wholly in some, partially in others. Fig. 1 illustrates the average area of trigeminal anaesthesia after total ganglion injections. The anaesthesia is total to pin and to pressure in front of the line A B C, a narrow area of diminished sensibility separating the total loss from the normal. Very occasionally the supra-orbital area of analgesia to pinprick may extend as far back as the occiput. In one case the tympanic membrane and anterior wall of the auditory meatus were totally anaesthetic, but usually the sensitiveness is only diminished.

In 5 other cases total temporary ganglion anaesthesia was produced, but partially faded off the upper two divisions, leaving total third-division anaesthesia, and loss to pinprick only on the upper two. In 7 more total permanent anaesthesia resulted on the second and third divisions, with partial loss over the ophthalmic division. In another case, in which the pain was entirely limited to the second division, I was able to inject the middle third of the ganglion only, causing total anaesthesia of cheek, side of nose, upper lip, and palate, but practically none on the forehead or eye, lower lip or tongue. In 5 more cases total third-division anaesthesia was obtained, but only partial loss on V.2 and V.1, while in 3 I failed to obtain any ganglion anaesthesia at all, or to pass my needle through the foramen ovale. In these I had to be content with injecting the third and second divisions separately at the foramen ovale and foramen rotundum. This can usually be done fairly quickly after injecting the third division, by partially withdrawing the needle, turning it forwards and pointing to the external canthus, so as to slip in front of the external pterygoid plate, and there to pierce the superior maxillary nerve just after its emergence from the foramen rotundum. I find this posterior route usually more satisfactory than passing the needle in front of the coronoid process; there is less risk of haematoma, and the same puncture is used as for the foramen ovale. In the remaining 3 cases, while in all there was temporary total ganglion anaesthesia, only partial lasting anaesthesia resulted in either division.

In all the cases the neuralgia was arrested. That the cure will be permanent I do not pretend, but it will certainly be permanent in the 13 cases of total ganglion anaesthesia, and probably in the 8 cases of total anaesthesia of the upper two divisions, and the 7 cases of total second- and third-division anaesthesia. Some of the 10 cases of total third-division anaesthesia may also escape recurrence, but in the 3 in which there was only incomplete anaesthesia of any division the probability of recurrence at some future date is considerable. It will be very interesting to watch the careers of my 2 cases (1 in hospital) in which only the middle third of the ganglion has been destroyed by the alcohol, causing anaesthesia over the second division only.

Thus of 45 private cases in the last twelve months I failed to inject the ganglion in 3 only, or 7 per cent., having to be content with injecting the separate branches. In 28 cases, or 62 per cent., there is very considerable probability of a permanent cure, and a fair chance in another 10 cases, or 22 per cent., making 84 per cent. of cases in which the chances of a permanent cure may be called reasonably good.

POSSIBILITY OF RECURRENCE IN INCOMPLETE GANGLION OR ROOT DESTRUCTION

I have seen recurrence of second-division neuralgia nine years after I injected the inner two-thirds of the ganglion, causing total permanent anaesthesia of the first division, with fairly dense partial anaesthesia of the second branch. After nine years the first division was still totally anaesthetic, but sensation was again normal on the other two divisions. Re-injection of the ganglion again produced moderately dense anaesthesia of V.2 and V.3 with complete relief of the pain.

The longer my experience, the more I feel convinced that there can be no guarantee against eventual recurrence of neuralgia unless there is produced total and permanent trigeminal anaesthesia. It is true that many cases go free for a great many years with much less than total anaesthesia, and others may be permanently cured, but so long as there is some conduction of sensation remaining on either of the two lower divisions, and even of the ophthalmic division, the possibility of recurrence must be reckoned with. Hutchinson's operation of leaving intact the inner portion of the ganglion, originally an unintentional omission of removal of the whole ganglion which he set out to do, but afterwards repeated as his usual method, left normal sensation over the first division, thus avoiding the risk of keratitis. I have met with three cases thus operated on, in which recurrence of the neuralgia appeared from two to ten years afterwards. Similarly, for the fractional root resection method as elaborated in America and advocated by Mr. Jefferson, though the majority may turn out to be permanent cures, yet I feel sure that recurrences will be met with, and a second operation for the recurrence of neuralgia is likely to be far more difficult than the first. Of Dandy's 200 cases, operated on by the subcerebellar route, 3 recurrences were noted, and I observe that Cushing, in his remarks at a meeting of the American neurological surgeons in the discussion on Dandy's paper, stated that he himself still practised resection of the entire root.¹

In those cases of ganglion injection in which I have injected the inner portion of the ganglion, and left the third division with full sensation, should recurrence of the pain happen a further injection should be as easy as on the first occasion, as the sensory guide of the third division is unimpaired. I have frequently heard the statement repeated that though the first alcohol injection may be satisfactory for a time, a second injection is of no use. This is quite untrue, except in cases which have been so frequently injected that a condition of fibrosis in the zygomatic fossa has been set up, which renders manipulation of the needle difficult; there is no possibility

¹ *Arch. of Neurol. and Psychiat.*, 1932, xxvii, 22.

of the nerve becoming immune to alcohol. The worst case of fibrosis I have met with was in a lady who, some years before the war, had been operated on and who carried her "ganglion" with her in a little spirit bottle. Her neuralgia was unchanged, and there was no trace of facial anaesthesia. Injection was quite impossible, so I asked Sir Victor Horsley to operate, which he did quite successfully, finding the real ganglion quite untouched.

Such fibrotic cases are particularly impossible to inject satisfactorily, and the open root-section operation is then the only remedy. As I have already said, in a certain proportion of other cases it will no doubt be found impossible to obtain satisfactory ganglion anaesthesia, and root section will probably be required sooner or later, but in a large proportion of cases of trigeminal neuralgia it will be found possible to obtain dense or total ganglion anaesthesia, probably in over 80 per cent., either by the route I usually use through the sigmoid notch, or by the longer anterior route. Anaesthesia that has persisted unaltered for a month after injection of the ganglion may be considered as permanent and unlikely to diminish to any marked extent.

Care of the Cornea

When the first or ophthalmic division remains totally anaesthetic, there is a risk of neuroparalytic keratitis supervening, unless the eye is protected for the first few weeks. A shade over the eye, or goggles, should be worn from the first, and the eye should be bathed with warm boric lotion twice daily. No soft pad of any kind is to be allowed between the eye and the shade, as the anaesthetic cornea would be liable to rub against it and be destroyed. If keratitis appears, the outer halves of the lids should be "rawed" and sewn together, and kept fastened for three months at least. Closing the lids is a sure cure for the keratitis if the latter is not allowed to progress beyond the initial stage of loss of the superficial epithelium in the centre of the cornea; such a shallow ulcer disappears entirely within twenty-four hours after closing the lids, and no scar whatever results.

PARTIAL INJECTION OF THE GANGLION.

Although partial destruction of the ganglion, or of the sensory root, is not a certain and permanent cure for the neuralgia, whether obtained by the open operation or by alcohol injection, yet it is often advisable to inject only the outer two-thirds or the inner two-thirds of the ganglion, according to whether the neuralgia affects mainly the third division or the second division of the nerve. In a certain number of cases it may be considered too risky to endanger the sight by producing total anaesthesia of the cornea when the sight of the other eye has already been partially or wholly lost through accident or disease. Great care must then be taken to inject very slowly, and not to push the cutaneous anaesthesia beyond the recognition of pressure on the upper eyelid and forehead.

In another large group of cases the incidence of the neuralgia is entirely restricted to the third division of the nerve, never invading the upper lip or nose. In these again a permanent cure may be obtained by a successful injection of the outer two-thirds of the ganglion, so as to produce total third-division anaesthesia with moderately dense anaesthesia of the upper lip, cheek, and upper jaw, and little or no anaesthesia of the eye or of the rest of the upper division. This I have done in a large number of cases, many of which are still completely free from pain since the injections were done, fifteen to twenty years ago.

First-division neuralgia never complicates third-division neuralgia unless the second division is also involved, and first-division neuralgia probably never exists alone without the pain ultimately declaring itself over the

territory of the second division. The longest time I have known the distribution of the neuralgia to be strictly limited to the first division, before the pain spread into the nose and lip, is four years. It should be unnecessary to mention that true tic first-division neuralgia, existing alone, must be very carefully distinguished from other forms of periodic pain, such as sinus infection and migrainous neuralgia.

Again, second-division neuralgia frequently refers along the eyebrow and lower half of the forehead, in addition to the temple, upper jaw, ala nasi, and upper lip, and yet may disappear entirely after an injection of the second division alone at the foramen rotundum. Such a distribution of the pain invading the lower half of the forehead, without involving the eyeball or shooting to the top of the head, should not be regarded as necessarily involving the first division unless it persists after a successful injection of the second division.

NEURALGIA OF THE SECOND AND FIRST DIVISIONS

Just as in many cases the neuralgia is limited to the third division, so in an approximately equal number of cases it may be limited to the second division, and in a small proportion of cases the first division is definitely involved together with the second. In the latter case, it is a quite safe and very suitable procedure to inject the inner portion of the ganglion to produce anaesthesia of the forehead, eye, and upper jaw, and yet leave good sensation on the lower jaw, lower lip, and tongue, which adds very considerably to the comfort of the patients afterwards when eating. This I have done on many occasions, my method being to use novocain only for injecting the third division when found at the foramen ovale, and not to inject alcohol until the needle has been pushed inwards for another quarter of an inch through the foramen ovale. I have thus produced very satisfactory deep and permanent anaesthesia of the upper two divisions, while the sensation returns over the lower jaw and tongue practically completely in an hour or less, as soon as the novocain anaesthesia wears off. Should neuralgia ever return in these cases, or should it later invade the third division, reinjection will be as easy as on the first occasion, because the sensitiveness of the third division as a guide is unimpaired.

Fig. 2 illustrates anaesthesia resulting from injection of the inner two-thirds of the ganglion in a woman, aged 68, who had suffered for fourteen years from severe neuralgic tic affecting the first and second divisions. The ganglion was injected on July 27th, 1931; the next day there was no sensory loss on V.3 and no motor paresis. The condition was still unchanged seven months later, with total sensory loss on V.1 and V.2, and complete relief of pain.

FIG. 2

I have also used this method in a few cases of persistent post-herpetic frontal neuralgia, when there was troublesome hyperaesthesia of the forehead. In such cases the intense persistent hyperaesthesia is often more cause of complaint than chronic pain, and anaesthetization of the inner portion of the ganglion gives considerable relief.

INJECTION OF THE MIDDLE THIRD OF THE GANGLION

Although injection of the third division alone at the foramen ovale is often most successful in neuralgia limited to that division, probably due to the outer part of the ganglion being also partially destroyed, yet the history of second-division neuralgias injected at or in front of the foramen rotundum is usually less happy, recurrence

often taking place in six to twelve months according to the density of anaesthesia produced, with a small proportion lasting from two to three years. One of my cases is still free after ten years, and I have seen four and five years' remission, but these longer periods are unusual.

I have therefore been more inclined for some time past to recommend and to practise injection of the inner portion of the ganglion, in order to obtain a lasting cure. I observe that Mr. Jefferson has divided the middle portion of the sensory root in two or three cases, in order to limit the anaesthesia to the area of the second division, and during the past six months I have in two cases successfully injected the middle portion of the ganglion only—in a man, a private patient, and in a woman at Maida Vale Hospital—for second-division neuralgia. My method is similar to injecting the inner portion of the ganglion, but after pushing the needle through the foramen into the ganglion, the alcohol must be injected even more slowly and carefully than usual, waiting perhaps for ten minutes at a time after each injection of two minims, and testing repeatedly with a pin as a guide to the developing anaesthesia. In both cases total shock anaesthesia of the upper two divisions developed at first, but after ten minutes sensation began to return. More alcohol then deepened the anaesthesia on V.2 but did not affect V.1, and gradually more and more injections of one or two minims at a time produced total lasting anaesthesia

over the second division alone, which was unchanged a week later.

Fig. 3 illustrates anaesthesia resulting from injection of the middle third of the ganglion, in a man, aged 57, who had suffered from flashing pain from the right upper lip to vertex for the past five years: 0.9 c.cm. 90 per cent. alcohol was injected on January 13th, 1932. There was total anaesthesia to pin and pressure on infra-orbital area, upper jaw, and palate as far back as middle of soft palate, and slight numbness and diminished sensibility to touch over the temporo-malar area. Anaesthesia was unchanged eight days later.

FIG. 3

Since I first injected the Gasserian ganglion in 1910 for trigeminal neuralgia, I have treated by this method some hundreds of patients, many of whom have been free of all pain for a number of years, and may be considered as permanent cures. When the injections are done by the methods I advise, slowly and with great care and patience, using light morphine-scopolamine anaesthesia, or local novocain only, according to the temperament and wishes of the patient, the results are most gratifying both to the operator and to the patient, while there is no risk whatever to life, and a minimum of expense and time.

DISLOCATION OF THE PATELLA *

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Dislocation of the patella is a comparatively rare condition, but it is nevertheless one of great interest on account of the factors involved in its cause and treatment.

AETIOLOGY OF OUTWARD DISPLACEMENT

Cases have been recorded of displacement occurring upwards or downwards, or inwards or outwards, but as outward displacement is by far the most common and the one which is found as a congenital condition, I am proposing to confine my paper to this variety.

Apart from the single traumatic dislocation, outward dislocation of the patella naturally divides itself into two main groups:

1. *Congenital*, in which the patella is permanently displaced and fixed on the outer side of the femur.
2. *Recurrent*, in which the displacement occurs either at infrequent intervals or as frequently as the knee is put through its range of movement.

It is generally accepted that the patella is a sesamoid bone in the tendon of the quadriceps. As Mackenzie¹ has said, its function is to improve leverage and thus increase the power of the muscle. It acts as a pulley and, by enabling the quadriceps to work at an angle, increases the work done by each contraction. The patella is an integral part of the extensor mechanism of the knee-joint—in dealing with its displacement, therefore, it is necessary to consider this mechanism in some detail.

THE EXTENSOR MECHANISM

The extensor muscle of the knee is the quadriceps. It consists of four muscles—the rectus femoris, the vastus externus, the vastus internus, and the crureus. All are supplied by branches from the anterior crural nerve, but these branches are so widely separated from one another in their distribution that they can be considered and injured as individual nerves. To obtain insertion, the

tendons of the four muscles unite and become attached through the ligamentum patellae to the tuberosity of the tibia. In addition, fibrous expansions on each side are attached to the capsule of the joint and to the anterior surface of the upper end of the tibia and the fibula. These are called the lateral patellar ligaments. On looking at the quadriceps and its attachment as a whole, one notices, as Goldthwait and others have pointed out, that in full extension the line of pull of the muscle makes an angle with the line of the patellar tendon. This angle is obtuse outwards, and is caused by the fact that when the knee is in the extended position the tibia and the femur are not in line with one another. For in this position the width of the pelvis and the length of the femoral necks separate the upper ends of the shafts of the femora while the lower ends are in close proximity. This would naturally result in an obliquity of the knee-joint, which, however, is prevented by a relative increase in the length of the internal condyle of the femur. This makes the joint horizontal, but results in throwing the femoral shaft out of alignment with that of the tibia. When the knee is flexed, though, the same conditions do not obtain, and the tibia and femur take up positions which become approximately parallel to one another. As the quadriceps clothes the shaft of the femur and the patellar tendon takes the line of the tibia, there must be an angle, more acute in the female than in the male, between the line of the muscle and that of its tendon, when the limb is extended (Fig. 1).

FIG. 1.—A, Showing angle between line of quadriceps and that of patellar tendon; and B, the alignment of the femoral and tibial shafts.

* From a paper read at a meeting of the British Orthopaedic Association at Nottingham, April 22nd, 1932.