

Neurotomy of the superior maxillary branch of the trigeminus : including neurectomy of the spheno-palatine ganglion for the relief of tic-douloureux / by Frederic S. Dennis.

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NEUROTOMY
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THE TRIGEMINUS,

INCLUDING

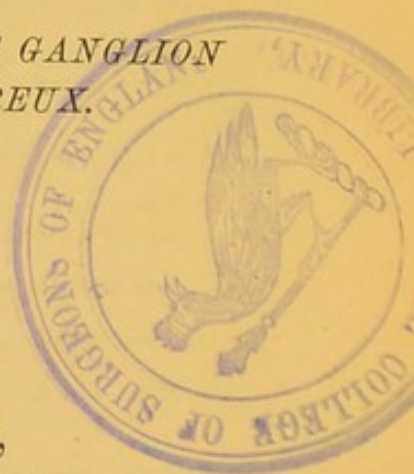
NEURECTOMY OF THE SPHERO-PALATINE GANGLION
FOR THE RELIEF OF TIC-DOULOUREUX.

PRESENTED
by the
AUTHOR

BY

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NEUROTOMY OF THE SUPERIOR MAX- ILLARY BRANCH OF THE TRIGEMI- NUS, INCLUDING NEURECTOMY OF THE SPHENO-PALATINE GANGLION FOR THE RELIEF OF TIC-DOULOUREUX.

THE use of the knife for the relief of neuralgia and the cure of diseases characterized by motor disturbances belongs to the resources of modern surgery.

The anatomical and physiological errors in regard to the nervous system, which had been taught by Galen and his school, continued to influence the theory as well as the practice of medicine throughout the Middle Ages. Not until the experiments of Cruikshank and others had proven that a section of a nerve-trunk did not cause permanent paralysis of the parts supplied by the nerve, and the clinical observations of John Warren in 1830, of Delpech, of Velpeau in 1830-'38, of Sir Astley Cooper, had shown that a section or resection of a nerve was often attended by the most satisfactory results: not until these experiments had been made did the theories of Galen lose their influence, and operations upon the nervous system come to be recognized as justifiable.

Of all of the so-called nervous disorders, for the relief of which an appeal has been made to the knife, in no other one has it more frequently been used than in neuralgia; and the literature of neurotomy, or of neurectomy, as a legitimate procedure, has developed about the treatment of this obstinate and oftentimes incurable complaint.

The scalpel, however, as abundant literature shows, is as yet far from being recognized by all as the classic means of curing neuralgia. While there are many who are willing to admit that it should be used as a *dernier ressort*, there are others who fear to make use of it under any circumstances.

The consequences of the use of this instrument, say some, are oftentimes more grave than the disease which it endeavors to cure. "It is not, however, the accidents which often attend, and the infirmities which follow these operations, that have done the most to bring them into disrepute, but because they seldom cure the evils for which they are performed."

Velpeau refers to a man fifty-five years old who submitted to several operations for the cure of a chronic neuralgia, in which all the nerves of the face were cut without the patient's obtaining any relief from his tortures.

Stromeyer teaches that neurotomy brings only momentary relief, and fails in any case to cure the disease. Wagner, of Königsberg, has given his views quite positively upon this subject, and recommends the section of nerves only in the case of peripheral neuralgias, after the arsenal of therapeutics has been exhausted.

Otto Weber, of Bonn, has taken a middle place, and, although recommending surgical operations upon the nerves for the removal of neuralgia, does not advise the section of large trunks.

In performing neurotomy, he says, a wound is made, which, by the counter-irritation it produces, may for a time remove the pain, which, however, sooner or later returns.

This operative procedure should be banished from surgery when it is invoked for the cure of a neuralgia that is central in its origin.

On the other hand, says M. Létiévant, "Success is the rule, and failure the exception." This enthusiast of nerve sections,

who has given rules for determining the course of the distribution of almost every nerve of the body by means of fictitious lines, muscular and bony prominences, and relations to arteries, claims for this operation many cures, immediate, continuous, radical.

"We can not blame," says M. Sedillot, "the boldness of surgeons who recommend neurotomy or neurectomy for the relief of neuralgia, inasmuch as the sufferings of the patient are intolerable, and bring them into a willingness to endure anything so that they may be delivered from their misery."

M. Nélaton recognized in such operations a cure for many protracted and rebellious neuralgias. Fauçon, in a thesis entitled "Resection of the Nerves in Nervous Affections," has embodied the opinions of the school of Strasburg, and given the indications which should be the guide to surgeons in this department of operative surgery, and writes: "Resection of the nerves, although often followed by relapses, is nevertheless preferable to all the other therapeutical measures, inasmuch as it is generally practiced after the latter have been tried to no purpose, and because with a modicum of danger it almost invariably procures for the unfortunate victim of neuralgia a temporary relief, and in some cases a complete cure. In nerve sections, Jaccoud recognizes the highest resource of medicine . . . which alongside of many reverses can boast of the successes of Patruban, Schuh, Beck, Bruns and Sedillot.

Differences of opinion and of practice such as those which have already been mentioned, and which at first sight seem to leave the subject of neurotomy for the cure of neuralgia an open question, will be found upon careful study to be due to erroneous theories concerning the disease and its treatment. Such errors, combined with empirical methods, and failure to select proper cases, errors of diagnosis and unscientific pathological deductions, produced at one time a general protest against this method of operating; so that for twelve years, 1840-'52, it is difficult to find the report of a single case of neuralgia treated by the use of the knife.

To the polemics of Stromeyer and his school modern surgery is indebted for this protest, which, more than any other

one thing, has led to the adoption of the more correct theories and successful practices of the surgeons of the past twenty years. And although much still remains to be done before it can be said that the physiology and the pathology of the nervous system have been advanced to their ultimate limits, enough has already been done in this direction by the laborers during recent years of such investigators as Erb, B. v. Langenbeck, Rosenthal, and Nussbaum, of Germany, Vulpian, Charcot, Brown-Séquard, of France, Callender and Hughlings Jackson, of England, Weir, Mitchell, Morehouse and Keene, of America, to revolutionize in many respects the surgical treatment of nervous diseases, and to restore to its proper place the section of nerves for the relief of neuralgia.

The discovery by Magendie of sensibility in the peripheral ends of the anterior roots of the spinal cord, and the more complete elaboration of the theory of recurrent centripetal sensibility, by Claude Bernard, Longet, Arloing, Tripier, and others, at a later period, have been of the greatest value in the study of the treatment of neuralgia, and justify the section of nerves for neuralgia as much as hæmorrhage warrants the ligature of a wounded artery.

Prior to these discoveries the opinions that prevailed have been well formulated by Müller, into a series of rules which are substantially as follows :

First.—Irritation of a branch of a nerve is attended with sensibility limited to that part of the body which is innervated by that branch, an irritation which never produces a sensation in parts supplied by other branches, either of the same nerve or of the same plexus.

Second.—If a part of the body is supplied with sensation by means of a plexus of nerves, after paralysis of one of the nerves which forms the plexus, the remaining nerves can not maintain sensibility throughout the plexus, and the extent of sensibility will depend upon the number of filaments that remain intact.

Such, in brief, were the accepted doctrines when, in 1864, Laugier reported to the Academy of Sciences the clinical history of a man in whom sensibility returned into the hand along the tract of the median nerve a few hours after the sec-

tion of that nerve: and the query was how to account for the sudden reappearance of sensation in this crucial case. A belief in immediate reunion could not be accepted, for the experiments of Phillepeaux and Vulpian had conclusively proved that a much longer time must elapse before a nerve, even if placed in the most favorable circumstances, could unite, while according to Müller's theories the solution of this perplexing riddle could only be obtained by assuming the existence of an anomalous distribution of the radial and ulnar nerves. But, notwithstanding this conclusion, equivalent to a *petitio principii*, Richet, in 1867, after having had an opportunity of studying a case similar to the preceding, accounted for the prompt return of sensation after section of the median nerve by the presence in the peripheral end of the nerve of recurrent or anastomotic fibers derived from the radial and the ulnar nerves—a theory which, in the light of modern discoveries, is altogether correct.

Such a theory stands the test of facts, and M. Claude Bernard, in his report to the Academy of Sciences upon the labors of MM. Arloing and Tripier in 1875, said: "This study of recurrent sensibility of nerves is not only interesting from the standpoint of experimental physiology, but this property of nerves also accounts for many clinical phenomena, which can not otherwise be explained."

In a paper read before the Academy of Sciences, these two physiologists embodied the results of their experiments, which were made upon the toe of a dog, to verify the correctness of their hypothesis as to the existence of recurrent centripetal fibers in the terminal nerve plexuses of the body, somewhat as follows:

Three of the four nerves of the toe were carefully cut, and an hour or so afterward sensibility to pain and touch was found at all points of the toe. The preservation of only one of the nerves was sufficient to convey to the sensorium impressions made upon any part of the toe.

This persistence of sensation in all the parts of the toe could only be accounted for by supposing that fibers (recurrent centripetal fibers) derived from the uncut nerve existed in the territory of the cut nerves, and through them commu-

nication between the centers and all parts of the surface of the toe was maintained.

Their theory was verified by facts, inasmuch as, a month after the section of three of the digital nerves, these experimenters discovered a number of fibers in the peripheral ends of the nerves that had been cut that had not undergone degeneration, while, in the nerve that had *not* been cut, fibers that *had* degenerated were also found; consequently, they concluded that the sensory nerves of any region are in the relation of mutual dependence as regards one another, and are not, as regards their function, isolated. Further experiments upon the lower animals, horses, dogs, cats, demonstrated also that these accessory or recurrent fibers are most abundant in the terminal plexuses of the nerves; that their number decreases inversely as the distance from the surface of the body, and that a point upon the nerve-trunk may finally be reached at which all recurrent fibers terminate. Such points have been determined by them for the nerves of the face, and those of other parts of the body.

These brilliant experiments throw a flood of light upon the physiology of the nerves, they interpret clinical facts, and suggest for the treatment of neuralgia more rational methods than those that have heretofore prevailed. They also teach:

1. That peripheral neuralgias are of much more frequent occurrence than the theories of Vulpian, Anstie, and others will allow, who claim that the great majority of alterations of nerve-tissue, causing neuralgia, are located, either primarily or secondarily, in the nerve-centers.

2. They aid in discovering the site of a material lesion of the nerves, whether it be of central, or of peripheral origin; a question of the first importance, and one that should carefully be determined before any treatment is begun.

3. They justify the section of adjacent nerves (polyneurotomy) for the treatment of peripheral neuralgias which continue after the section of a single nerve (mononeurotomy).

4. They show that a neuritis, perineuritis or sclerosis of the facial may, by involving the recurrent fibers of the trigeminus, produce trifacial neuralgia (reflex neuralgia):

5. That failures, following certain cases of resection of nerves for the cure of peripheral neuralgia, are no arguments against the method of operation, but indicate an error of diagnosis as to the location of the cause :

6. That an atrophy, a degeneration, an inflammation, sclerosis, neuroma, exostosis, periostitis, a foreign body, or any other cause by which the nutrition of a nerve may be impaired, produces neuralgias more amenable to treatment if they affect nerve-trunks than if they involve the terminal filaments of nerves :

7. That neurectomy is more likely to be successful than neurotomy, if the neuralgia is due to changes in the periphery of nerves :

8. That these cases of neuralgia will terminate most favorably after an operation if a primary lesion of the nerve centers can not be discovered, and provided the cause producing the neuralgia is at a point sufficiently near to the brain or spinal cord to be free from recurrent fibers of adjacent nerves :

9. That operations will prove successful according as they are performed sufficiently near to the nerve-centers to include all the direct fibers of the nerve which is diseased, while excluding all the indirect fibers of adjacent nerves.

As thus far pursued, the study of neuralgia and of its treatment has been, for the most part, a study of the cause and treatment of facial neuralgia; for neuralgia was first recognized by Arétée as a distinct disease in connection with pain along the tract of the trifacial, and it was for the cure of a rebellious neuralgia of the face that neurotomy was first performed by Maréchal, surgeon to Louis XIV.

The superior maxillary branch of the trigeminus, which is contained within a bony canal, rendering disturbances of its nutrition by pressure of the slightest degree possible, and which is also connected by Meckel's ganglion with other nerves of the face, has always been a favorite seat of neuralgia, and has afforded for nearly two centuries opportunities for the display of bold, conservative, successful surgery.

No nerve offers more satisfactory and gratifying results than the superior branch of the trifacial nerve when neurec-

tomy is performed upon it, provided only the proximal section of the nerve be made between Meckel's ganglion and the foramen rotundum, so as to include all the direct fibers of the main trunk, while excluding all the recurrent fibers which are derived from the ganglion through its branches of distribution to the superior maxillary nerve.

Leaving the consideration of the theory of neurotomy as a cure for facial neuralgia to record the facts, the cases will be classified and arranged chronologically as regards the duration of relief from pain which was obtained by the operation.

The *first* class will include all cases in which the patients continued free from pain for twelve to eighteen months or longer.

The *second* will contain those in which pain recurred at some time between the sixth and the twelfth month.

The *third* will comprise those cases in which relief continued for a period varying from one to six months only.

The *fourth* will include all those in which pain returned during the first month.

The *fifth* class will be made up from the cases in which no pain was felt so long as patients remained under observation in hospital or elsewhere, but which, on account of the short time of observation—usually one or two months only—are not evidences for or against the merits of the operation.

Finally, in determining the successes, each one must judge according to his ideas of what constitutes success, recollecting that Stromeyer, who represents the views of the bitterest opponents of this method as well as of all others which require the use of the knife in the treatment of neuralgia, declares that fourteen months relief from pain does not constitute success, while on the other hand Létievant, after the analysis of several hundred cases of nerve sections for the cure of neuralgia, states that relapses generally occur during the first few days subsequently to the operation, and that the cures which have survived the first few weeks should be regarded as radical, successful, complete.

What are the facts?

OBS. I. Joseph Jones, æt. 42, U. S. Dr. James R. Wood.
—Consulted me at my office March 20, 1866. He had suf-

ferred for several years with facial neuralgia, the right superior maxillary nerve and its branches being the organs affected. During the last year his suffering was intense. He had been treated by many medical men, and all forms of narcotics and anti-periodics were given in large doses, without permanent benefit. The infra-orbital nerve had been subcutaneously divided repeatedly with but slight relief. His habits had always been good. He had led a sedentary life, his occupation being that of a clerk. I proposed to him the exsection of the superior maxillary nerve, at the point where it makes its exit from the foramen rotundum of the sphenoid bone into the sphenomaxillary fossa. I explained the operation to him, and he being an intelligent man, I invited him to witness the operation on the dead body at my private room at Bellevue Hospital Medical College. He witnessed the operation and wished me to perform it upon him at an early day. On April 2, 1866, I caused him to be put under the influence of sulphuric ether, and performed the following operation. The patient was placed in a chair in a reclining position. The day being a bright one fortunately, I placed him near a window, so that the rays of the sun fell upon his face, which enabled me to see with distinctness the most profound steps of the operation. I then made an incision, commencing near the inner canthus of the right eye, carrying it in a semilunar shape, until I reached a point a little below, and without the outer canthus of the eye. I then dissected up the flap; I then made a perpendicular incision, extending from a point opposite the center of the convex edge of the crescent-shaped incision, to near the vermilion border of the upper lip, without opening the buccal cavity. I then reflected back the integument to the right and left, being careful not to include any other tissues. I then dissected down to the superior maxillary nerve, where it makes its exit from the infra-orbital foramen. I proceeded to dissect out the branches of this nerve as far as practicable. These branches when the dissection was completed resembled the *corda equina* of the spinal cord in a miniature form. I then dissected away all the areolar and adipose tissues down to the periosteum. I then carefully separated the periosteum, and reflected it from the anterior surface of the superior maxillary.

I then with a trephine carefully removed the anterior wall of the antrum of Highmore, leaving the inferior orbital foramen intact, with the branches of the nerve reflected upon the superior flap. I then with a smaller trephine removed a disk of bone from the posterior wall of the antrum, which exposed the sphenomaxillary fossa.

There had been but little hæmorrhage during the operation until then, when there was a welling up of blood from the sphenomaxillary fossa. A sponge attached to a holder was introduced, and pressure made for a few moments, when the bleeding ceased. I then commenced to break up the inferior wall of the infra-orbital canal beginning at the inferior portion of the infra-orbital foramen, being careful not to injure the nerve. This I did with a small chisel and a strong pair of scissors. I then dropped the nerve into the antrum and traced it without any difficulty through the sphenomaxillary fossa, to the distal end of the foramen rotundum where the nerve makes its exit into the sphenomaxillary fossa. I then with a pair of long curved scissors divided the nerve at a point where it made its exit from the foramen rotundum into the sphenomaxillary fossa. I then broke up Meckel's ganglion, which lies at the inner aspect of this nerve at this point. After waiting a short time, there being no hæmorrhage, the integuments were brought together with interrupted silver sutures and adhesive strips, after thoroughly bathing the parts with carbolized water. There was a tent introduced at the lower angle of the perpendicular incision, to permit the discharge of blood or pus which might occur, then a compress of carbolized jute was placed over the wound and retained by adhesive strips. The patient came readily from under the influence of the ether. I remained with him for about an hour after the operation, during which time he did not suffer any pain. Having been in the habit of taking morphine for a long while, I ordered a grain of morphine to be given at bedtime. I found him the next day free from pain, having passed as he expressed it a "heavenly" night. His pulse was 90, skin hot and dry, temperature 100°. I ordered spirits of mindereus, an ounce once in two or three hours. In the evening his pulse was 88, temperature 99°, and I ordered one grain of

morphine at bedtime. I saw him each day, and no unpleasant symptoms occurred, and on the sixth day the wound had entirely healed, with the exception of the inferior angle of the perpendicular incision. There was but little discharge of blood or pus from the dependent opening. The perpendicular incision entirely healed on the eighth day, and in three weeks after the operation he called at my office, saying that "Richard was himself again." I saw him occasionally for two years after the operation. He informed me that he had not suffered any pain since he came from under the influence of the ether. I then lost sight of him, as he had removed from the city.

OBS. II. Exsect. sup. max., including Meckel's ganglion, from the foramen rotundum to the infra-orbital foramen. (Wood, James R., Emeritus Professor of Surgery Bell. Hosp. Med. College, N. Y. Unpublished letter, 1876.)—Wm. S. R. Taylor was admitted into Bellevue Hospital, October 6, 1873. He was born in Scotland, and is at present fifty years old. Has been a telegraph operator for a number of years, but was obliged to abandon his position on account of facial neuralgia. Family history is of no special importance, aside from the fact that some of his ancestors had been similarly affected. Patient has been for the most part well, and lived along time in South America, where he suffered from malarial fever.

No history of specific disease can be obtained from patient, and inspection does not disclose any of its lesions. He is addicted to no bad habits, but drinks occasionally. Ten years ago he began to suffer from left infra-orbital neuralgia, and was a victim of this malady to the time of his admittance to the Hospital. Everything in the way of drugs had been tried to free him from the excruciating pain with which he had for many years been afflicted. Two unsuccessful operations upon the infra-orbital nerve at the foramen of the same name had been already performed, but to no purpose.

In this deplorable state of mind he came to me, willing to sacrifice his life to be free from pain.

On the 25th of November, less than four weeks after the operation, the patient left the Hospital entirely free from pain.

In March, 1876, having the previous year called upon Mr. Erichsen in London, who examined this very interesting case at that time, the patient visited me at my office and said he had not had the slightest intimation of the presence of his old and dreaded enemy since leaving the Hospital.

OBS. III. Exsect. sup. maxil. nerve (Schuppert, New Orleans. Private letter from Dr. Schuppert to Professor Conner, "Am. Jour. Med. Sciences," 1870): "After the lapse of several years no return of the pain has taken place." Also see private letter from Dr. S. to Professor Blackman, "Cincin. Am. Jour. Med. Sciences," 1869, concerning this case: "There has reappeared at different times a neuralgic pain, but of such an indifferent character that . . . he has not been prevented from attending to business, a condition which, if not satisfactory to the professional fault-finder, is at least so to the men who are the true judges in such controversy." About two years after the operation, patient was in the satisfactory condition above reported.

OBS. IV. Exsect. of the trunk of the second branch of the fifth pair of nerves beyond the ganglion of Meckel, for severe neuralgia of the face, etc. (J. M. Carnochan,* Professor of Surgery in the N. Y. Med. College, etc., "Am. Jour. Med. Sci.," new series, vol. xxxv.). Upon a man sixty-nine years old, who for five years had suffered from severe facial neuralgia, which utterly incapacitated him from pursuing his profession of medicine. Carnochan exsected the nerve at its exit from the foramen rotundum. Relief was immediate. The nerve was found much larger than normal, neurilemma was very vascular, and the nerve proper engorged and red. The length of nerve removed was a little more than an inch and three quarters. Fourteen months after the operation, patient was free from pain.

OBS. V. Exsect. of the trunk of the inf. dental nerve, together with that of the second branch of the fifth pair of nerves beyond Meckel's ganglion for severe facial neuralgia. (George C. Blackman, M. D., Professor of Surgery in the Medical College of Ohio, etc., "Am. Jour. Med. Sciences," 1869,

* Carnochan was the first one who performed this operation.

vol. ii., p. 69.). Upon a woman who had suffered for fourteen years from a "violent headache and toothache." In 1866 a portion of left inferior dental nerve was exsected. Pain subsided and did not return for several months. Seven days after the exsection of the inf. dental nerve, which did not remove the pain from the upper jaw, Dr. B. performed Carnochan's operation for the removal of the second branch of the fifth pair beyond Meckel's ganglion. Sixteen months after the operation, the patient had had no return of pain. Twenty months after the operation pain returned.

OBS. VI. Section of the sup. max. (Dr. A. Wagner, Professor of Surg., Koenigsberg. "Arch: fur klin. Chirurg.," Langenbeck, vol. xi.) Upon a woman thirty-five years old, who for fourteen months had suffered from a neuralgia of the superior and posterior dental nerves. Neuralgia ceased at once, and twenty months after the operation pain had not returned.

These cases comprise the first class. So far as is known in none has pain ever recurred, the case of Obs. V. alone excepted. (See sequel of a case of exsection of the trunk of the inf. dental, together with the second branch of the fifth pair of nerves beyond Meckel's ganglion, for severe facial neuralgia. Blackman, etc., "Am. Jour. Med. Sciences," 1870, vol. ii., p. 373.) They are sufficient to contradict Stromeyer, where he says that neurotomy only affords momentary relief.

OBS. VII. Exsect. sup. maxillary nerve, etc. Wood, Jas. R., Emeritus Professor Bellevue Hosp. Med. College, N. Y. Unpublished letter, 1870.—Emma B. was sent to me with reference to the relief of facial neuralgia. She stated that she had been under the care of several physicians at different times, who had performed at different times subcutaneous operations upon the infra-orbital branches, but to no purpose.

She consulted me with a view of having the superior maxillary nerve extirpated, and I finally, at her request, determined to operate upon the superior maxillary nerve high up, at a point as near as possible to the foramen rotundum of the sphenoid bone. On the 29th of September, 1869, after a thorough examination, and after a consultation upon the question of an operation with my colleagues, it was decided to ex-

sect the nerve. The patient having been put under the influence of an anæsthetic, the operation was performed in accordance with methods which I have given in a previous letter. She came out of the state of anæsthesia very nicely, and from the time she recovered consciousness, for four months (January 29, 1870), she never experienced a pain in the face.

The wound was treated in the same way as the first-mentioned case, and no unfavorable symptom occurred to delay a speedy recovery.

Patient called upon me in June, about nine months after the operation, to state that new pains had come into the lower jaw, which, upon examination, were found to be in the course of the inferior maxillary nerve. Donovan's solution was prescribed, but, notwithstanding its use, the pain remained.

Her family physician, Dr. Daly, at Dr. Wood's suggestion, determined to remove a portion of the nerve at fault. He made an incision along the lower edge of the inferior maxilla, and having exposed the periosteum, which was carefully separated from the bone, the bone was trephined in four places.

The operation, performed in August, 1874, has been followed by entire cessation of the pain.

The case was heard from many months after this last operation, and up to that time patient had been perfectly well and altogether free from pain.

OBS. VIII. Exsect. sup. maxillary nerve, etc. Wood, James R., New York. Unpublished Letter. 1877.—Michael Doyle was admitted into Bellevue Hospital January 13, 1870. Five years prior to his admission he was attacked with a severe pain in the region of the upper lip, which extended from thence upward toward the left eye. The pain, which was severe in character, continued for about two years, then spontaneously ceased. He can assign for the attack of neuralgia no other cause than that of sleeping on the damp ground. After an intermission of the pain for six months, it returned, and was more severe than at first.

The present attack has continued nearly two years, and, although every drug has been employed to relieve him of his excruciating pain, no remedies have succeeded in doing so.

Family history shows no hereditary tendencies. Physical examination reveals normal lungs and heart. His life has been exemplary as regards drinking and smoking.

January 29, 1870, I extirpated, by methods already described, the superior maxillary nerve and Meckel's ganglion. The wound was then closed, the lower part of the left vertical incision being left open in order to allow free drainage. The wound healed normally, and nothing unfavorable occurred to delay repair. Patient continued free from pain for several months (5-7), when pains of a neuralgic character appeared in the tract of the inferior maxillary nerve.

I cut down upon the inferior maxilla and trephined it over the dental canal. I also, by means of a bistoury introduced into the mouth, divided the nerve just as it makes its entrance into the dental foramen.

Subsequently to this operation, a small piece of necrosed bone came away, but the patient had not, up to the time of his discharge from the hospital, which took place a month or so later, experienced any pain of the face. (May, 1873.)

In June, 1875, the patient returned to hospital, professing to suffer from his old enemy. He has become a confirmed opium-eater, and begs for the drug in a slavish and imploring manner. He has been carefully watched for many months, and the results of these observations have confirmed me in the belief that he suffers more from being deprived of the pleasure of opium-eating than from any actual pain. His appetite is very good, and he sleeps well, and, if he gets a hypodermic injection of a liquid resembling in appearance Magendie's solution, he is as comfortable and sleeps as well, whether it be morphia or distilled water, provided only the substitution is not too long continued at any one time.

November 7, 1877.—An abscess has formed on left buttock. An opening having been made, an immense quantity of pus was discharged.

9th.—The patient was given Magendie's solution ℥ 130, besides bromide and chloral.

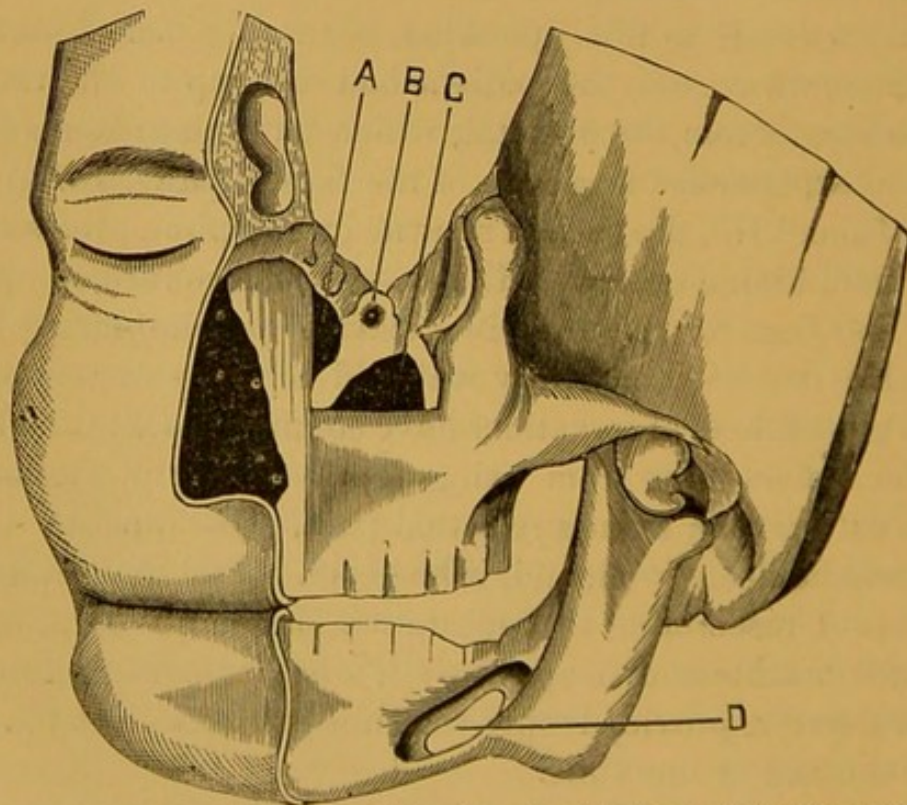
11th.—Magendie's solution, ℥ 200, pot. brom. 75 grs., chlor. hydrat. grs. 40, has been given during the day.

15th.—The patient received to-day Magendie ℥ 290.

27th.—Another large abscess has formed between scapulæ. For the past three weeks the patient has gradually been growing feebler; cornea has begun to ulcerate.

30th.—The patient has been unable to take solid food for twenty days. Brandy and egg-nogg have been given him at short intervals. For the past few days he has groaned almost constantly, and seems to have taken a great dislike to hypodermic injections.

After having passed a quiet night the patient died, at about eight o'clock in the morning, November 30, 1877. In the *post-mortem* examination the nerve could be seen entering the foramen rotundum from the proximal side, and no trace of it upon the distal side of the skull. The foramen was closed, on the interior surface, by bone.



A, Part of Nasal Cavity; B, Foramen Rotundum closed by bone; C, Opening into Antrum of Highmore; D, Where Inferior Maxilla was trephined for Inferior Maxillary Nerve.

This patient made a will, giving his body to me, and the specimen is now in the Wood Museum.

An examination of the intra-cranial portion of the trigeminus, by Dr. Welch, of the Bellevue Hospital Medical College, showed a very slight difference in the diameter of the superior maxillary divisions of the two sides.

That of the left (side of pain) is about three quarter mm. less in diameter than that of the right side.

On tracing the nerve in its course through the pons, the cross-section of the left trunk appeared of a somewhat deeper gray color than that of the right, but the microscopical examination (after hardening in Müller's fluid) showed the nerves well preserved, although there appeared to be a larger number of small nerve-fibers on the left than on the right side, but no other evident change could be demonstrated, in particular no degenerative changes in the nerve-fibers, and no increase of the neuroglia. A microscopical examination of the nucleus of the trigeminus showed the ganglion cells as usually deeply pigmented, but there was no difference between the nuclei of the two sides, and no evidence of disease of central origin.

OBS. IX. Exsect. of infra-orbital nerve nearly to the foramen rotundum. (Nussbaum, of Munich, "Report on Progress of Surgery," 1863-'65, by Dr. Gures, Berlin, translated by Dr. Schuppert in a letter to Dr. Blackman.) A female aged thirty-eight, suffering from traumatic neuralgia, had numerous dissections made of the supra- and infra-orbital nerves during a space of five years, before she came under Dr. N.'s treatment.

During the next two years, repeated extirpations of the cicatrices were made, the common carotid tied, the ascending ramus of the lower jaw trephined, and the inferior dental nerve exsected, with mylo-hyoid and lingualis, causing necrosis of the bone, which had to be secured to the articulation. Five months later the neuralgia returned, when the infra-orbital nerve was exsected nearly to the foramen rotundum. . . . The pain had entirely ceased up to the time of publication, several months after the operation.

These three cases comprise the second class, in which pain was felt at the same time during the second six months, but was relieved by an operation upon adjacent nerves. In the two first, the pain appears in a different part of the face. In the third, innumerable operations fail to bring relief until the high operation is performed upon the superior maxillary nerve.

The first two, so far as the facial neuralgia of the superior maxillary is concerned, were permanently relieved by the excision of that nerve; no pain, so far as is known, ever after appearing in its tract.

In the third case, the high operation brings relief when all other possible methods, even the ligature of the carotid, had failed to do so. Each of the three is an irrefragable proof of the merits of the high operation, limited to the tract of the superior maxillary for the cure of neuralgia of the face. They are successes as much as the first class, but have been put by themselves to show, 1, that pain appearing in the course of the inferior dental, subsequently to an operation upon the superior maxillary, does not necessarily indicate the operation to be without success.

2. That failure to give relief does not prove anything as to the value of the operation or otherwise, if such a failure can be proved to be due to an error of diagnosis rather than to one of the knife. (Obs. IX.)

3. That a cause producing compression of this nerve in the infra-orbital canal, thus impairing its nutrition, may subsequently to such an effect, or simultaneously with it, appear in the inferior dental canal, and produce a similar effect upon the inferior dental nerve, which is equally favorably situated for compression.

4. Nerves traversing bony canals require no central lesion or a cause acting generally, to account for a neuralgia which attacks them, their anatomical relations to bony parts sufficiently accounting for such pain.

5. That these anatomical relations account for the great frequency of trifacial neuralgia as compared with other obstinate neuralgias.

Obs. X.—Resection of superior maxillary, soon after its exit from foramen rotundum. (Wagner, of Königsberg. Schmidt's "Jahrbucher," B. 146, p. 64.) Upon a woman forty-five years of age, for a neuralgia of twenty-three months' duration, upon whom Von Burow had performed neurectomy of the infra-orbital.

Wagner, suspecting a central cause which medicines failed to remove, determined to operate as near as possible to the

site of disease. Thirty hours after the operation the pain disappeared, but returned in three months.

OBS. XI.—Exsection superior maxillary. (Dr. Foote. Operation performed at Cincinnati Hospital, February, 1870. Case unreported.) “Pain returned in three months.” (Conner, “American Journal of Medical Sciences,” vol. ii., 1870.)

OBS. XII.—Extirpation of superior maxillary nerve and Meckel’s ganglion, for facial neuralgia. (Fowler, S. R., “Proceedings of Medical Society of Kings County,” 1877, p. 176.)

For the relief of neuralgia of eighteen months’ duration. Patient was unable to attend to business, and, discouraged with life, was well nigh the point of desperation. Operation occupied an hour, and was attended with slight hæmorrhage only.

The operation, so far as the relief of the infra-orbital neuralgia was concerned, was a complete success. The patient’s general health still continues to improve, but he occasionally complains of pain along the line of the lower jaw and in the lower teeth.

The writer states: “Should this continue I intend to exsect a portion of the inferior dental branch.”

OBS. XIII.—Exsection superior maxillary, etc. (Dr. Schuppert, New Orleans.) Case unreported. See private letter to Dr. Conner, loc. cit., p. 371.

“The pain returned, and before I finally succeeded in relieving the sufferer permanently, I performed several other operations, tying the carotid artery and resecting the facial nerve at the foramen styloideum. It is now over one year since I performed the latter operation, and the man has never since been affected with the slightest pain.”

These cases comprise the third class. With the exception of Obs. XII., they do not throw much light upon the operation as a justifiable procedure, on account of the meagerness of the clinical facts. Case No. 12 should be considered a success, inasmuch as pain had not returned to the region originally affected, but to that of the lower jaw; and is also another proof of similarity as regards pathological tendencies based upon anatomical resemblances which exist between the superior and inferior maxillary nerves.

OBS. XIV.—Osteoplastic resection of the upper jaw, and

removal of the second branch of the trigeminus from a point near the foramen rotundum. (Billroth, "Klin. Wochenschrift," No. 18, p. 196.)

The operation for a short time was followed by the most satisfactory results ; but about six weeks (year 1866) after the operation, pain was felt.

OBS. XV.—Neuralgia of the second branch of the trigeminus, resection of the trunk of the superior maxillary nerve at the foramen rotundum, according to the Carnochan method. (Professor Podrazki, Vienna, "Wien. Medicin. Wochenschrift," No. 103, 1869, p. 1710). Upon a man thirty-six years of age, for neuralgia without a known cause, which attacked the patient while washing his face. Resected nerve measured two inches, and was found to be remarkably thick and deeply congested.

Pain left the region of the superior maxillary after the operation, but after a day or so appeared in the supra-trochlear nerve. Careful watching of the patient, together with his own statements, did not leave a doubt as to whether the pain was due to an "irradiation" from the infra-orbital or to an "independent" neuralgia of the frontal.

Eleven days after the first operation, resection of the frontal nerve was made just before it divides into the supra-orbital and supra-trochlear branches.

Fourteen days later the patient, free from pain, was obliged to leave the hospital, and since then nothing has been recorded concerning him.

OBS. XVI.—Section and removal of the superior maxillary nerve and Meckel's ganglion for neuralgia. (Cheever, David W., "Boston Medical Reports," 2d series, Boston City Hospital, 1877, p. 262.) Results of the operation. At first the pain entirely disappeared. It slowly recurred, and patient was obliged to take opium.

Two years after the operation, in reply to a letter addressed to her by Dr. C., who desired to know whether she had been permanently benefited by the operation, she wrote: "Only to destroy the pain in the immediate locality of the operation. On the other cheek, temple, and in both lower jaws, it is as bad as ever."

OBS. XVII.—Removal of superior maxillary nerve, with the ganglion of Meckel, and the inferior maxillary nerve, for persistent facial neuralgia (Wm. H. Mussey, Cincinnati, "Cincinnati Lancet and Observer," August, 1869, vol. xii., p. 449.)

Upon a man thirty-two years of age, who, after exposure to intense cold, began to suffer from neuralgia, confined chiefly to the superior maxilla. For five years the patient resorted to all kinds of medical treatment without obtaining relief. During the operation the ganglion of Meckel and the superior dental nerves were clearly demonstrated and removed. Pain entirely left the superior maxilla, but in the course of the following two months was felt along the inferior dental nerve, and became so severe that an operation for the removal of that nerve was performed. After recovery, the patient writes: "The operation is a complete success."

This case concludes the fourth class, which teaches:

1. That in some cases at least neuralgia may be as isolated as the distribution of a single nerve, while, on the other hand, it may be as general as the distribution of all the nerves of the body.

2. That exsection of the superior maxillary nerve will not cure a neuralgia limited to the inferior maxillary nerve, any more than exsection of the latter will relieve a neuralgia of the former.

3. That it would be as reasonable to banish the deligation of arteries from operative surgery for the treatment of aneurism, because after the cure of a femoral aneurism by the ligature an aneurismal tumor should subsequently develop upon the external iliac artery, as to cast away the section of nerves for neuralgia because the section of some particular nerve, which is followed by relief so far as the cut nerve is concerned, does not relieve the neuralgia of some other nerve.

OBS. XVIII.—Exsect. of trunk of the second branch of the fifth pair of nerves, etc. (Carnochan, N. Y., "Am. Jour. Med. Sciences," new series, vol. xxxv., p. 139.) Upon a man, fifty-four years of age, who had suffered for many years from facial neuralgia.

The nerve exsected measured two inches, and was hyper-

æmic and thickened. Relief was immediate, and the cure complete. December 8th, about two months after the operation, the following remark is recorded: "Visited the hospital; still free from pain, and in good condition."

OBS. XIX.—Sect. and removal of the sup. max. nerve and Meckel's ganglion for neuralgia. (Dr. Thorndike, Boston, "Boston City Hospital Medical Reports," second series, p. 262.)

Upon a fisherman, suffering from pain confined to the region of the infra-orbital nerve and its distribution. The nerve was traced to near the foramen rotundum and cut off, and with it the sphenopalatine was removed.

The wound healed readily, and one month after the operation the patient was discharged. Up to the date of discharge there had been no return of pain.

OBS. XX.—Exsect. of the trunk of the sec. branch, etc. (Carnochan, *loc. cit.*) Upon a woman who had suffered six years from neuralgia of the face.

The nerve, which was removed for a distance of two inches, was found enlarged, very vascular, thickened, red. Relief was immediate. One month after the operation no relapse had occurred. The sensibility of the face was perfect fourteen months after the operation.

OBS. XXI.—Resect. of the sup. maxillary. (Linhart, of Würzburg, "Deutsche Klinik," "Gaz. Hebdomadaire," 1860.) Upon a man forty-three years old, who had suffered from neuralgia for seventeen years.

A resection of the infra-orbital brought immediate relief, but a relapse soon occurred.

A second operation was performed, and an additional inch of the infra-orbital branch removed, and at the same time a resection of the superior maxillary was performed by means of the galvano-cautery. Relief was immediate. Notwithstanding an abundant hæmorrhage, which nearly proved fatal, the patient made a rapid recovery, and at the end of the sixth month after the operation no pain had returned. This case concludes the observations.

The value of this operation, as affording relief to the sufferer, and the dangers involved to the patient, may be seen at a glance by reference to the following table. These cases are all that could be found including the removal of the sphenopalatine ganglion with the nerve trunk. They have been arranged in the order, as far as was possible, of the length of time after the operation that the patient enjoyed immunity from pain.

Many eminent and distinguished surgeons have contended that extirpation of Meckel's ganglion with the superior maxillary branch is not necessary. Foremost among those who entertain this view is Langenbeck, whose vast clinical experience and wide observation entitles his opinion to the highest respect. He believes the disease has in most cases a specific character, and in his judgment medication, with this in view, should in all cases be adopted. The record of his cases substantiates his views, and the operation known as his has met with magnificent results. If the disease is entirely peripheral and specific in its nature, undoubtedly Langenbeck's operation is most satisfactory. A careful study of the experiments of physiologists as to the intricate interlacements and inosculations of nerve plexuses, a *resumé* of which has been given, shows that the ganglion must be removed if the disease is to be radically cured. This opinion receives additional weight in the history of some of the cases reported, where complete and permanent relief was not obtained until the sphenopalatine ganglion was extirpated. In many cases reported, in which the nerve-trunk has been exsected without removal of the ganglion, pain has returned. In many of these cases surgeons have given their opinion that the operation was consequently a failure. There is a significant lesson to be derived from the conclusions of the physiological investigations referred to in the first part of this paper, and if surgeons would adopt the precepts which these experiments establish, this operation would more often be followed by complete success, whereas heretofore it has been condemned from the reasons assigned.

	Operations.	Operation, by whom performed?	Operation performed, upon what nerve.	After operation, how long under observation?	After operation, was pain ever felt? If so, when?	After operation, was pain ever felt? If so, where?	From operation, number of deaths.
	No.	Names.	Nerves.	Months.	Months.	Nerves.	Months.
1st Class, 6.	1	Wood.....	Sup. Max.	24	..	.....	....
	2	Wood.....	" "	36	..	.....	....
	3	Schuppert....	" "	24	..	.....	....
	4	Carnochan....	" "	14	..	.....	....
	5	Blackman.....	" "	16	20	Sup. Max.	....
	6	Wagner.....	" "	20	..	.....	....
2d Class, 3.	7	Wood.....	Sup. Max.	84	..	Inf. Den.	....
	8	Wood.....	" "	86	..	" "	....
	9	Nussbaum....	" "	4 ?	..	.....	....
3d Class, 4.	10	Wagner.....	Sup. Max.	3	3	Sup. Max.	....
	11	Foote.....	" "	3	3	" "	....
	12	Fowler.....	" "	5	..	Inf. Den.	....
	13	Schuppert.....	" "	4 ?	4 ?	Sup. Max.	....
4th Class, 4.	14	Billroth.....	Sup. Max.	2	2	Sup. Max.	....
	15	Podraski.....	" "	1	..	.....	....
	16	Cheever.....	" "	1	..	Inf. Den.	....
	17	Mussey.....	" "	2	..	" "	....
5th Class, 4.	18	Carnochan....	Sup. Max.	2	..	.....	....
	19	Thorndike....	" "	1	..	.....	....
	20	Carnochan....	" "	1	..	.....	....
	21	Linhart.....	" "	6	..	.....	....

Number in which pain was increased.....	0
Number in which not increased.....	21
Number in which temporary relief was obtained.....	21
Number in which temporary relief was not obtained....	0
Number in which permanent relief was obtained.....	16
Number in which permanent relief was not obtained.....	5
Number of deaths due to operation.....	0

The preceding cases, although too limited to justify broad and comprehensive deductions, prove, nevertheless, the correctness of the following practical conclusions :

1. The high operation upon the superior maxillary nerve for the cure of neuralgia characterized by pain (*loci dolentes*, *points douloureux*), having its maximum of intensity at the infra-orbital foramen, in the course of the malar branch, and sometimes, although rarely, in the alveolar dental, superior labial, and palatine points, is a better operation than the lower

one, inasmuch as the preceding cases show that the former, as a secondary measure, has cured or brought relief in nearly every case in which the latter has failed to do so.

2. The operation is justifiable, as the record shows no case in which death has occurred as an effect of the operation, nor one in which the symptoms have been aggravated.

3. Relief, if only temporary, is a result which justifies the high operation for neuralgia as much as it does the one for the removal of malignant tumors, which, as a rule, invariably recur subsequently to their extirpation by the knife.

4. Want of success is due to failure as regards a correct diagnosis, not only of the cause of the pain, but also to failure as regards the site of the disease. If central, the diagnosis fails to determine whether the centers are primarily or secondarily involved, or, if peripheral, whether the recurrent fibers are or are not implicated.

5. Failure will be the rule rather than the exception, unless care is taken to distinguish those cases in which neuralgia is due to central lesions from those in which the cause lies in the periphery.

6. If the lesion is situated in the terminal nerve plexuses, polyneurotomy, or the resection of several nerves, will be more likely to remove pain than mononeurotomy, or the resection of a single nerve.

7. Mononeurotomy should be reserved for those cases in which the irritant involves the trunk of a nerve near its origin.

8. The prognosis will be the most favorable where lesions involving the plexuses or the nerve centers can be excluded.

9. The principal indication for the employment of this bold but safe operation is found in the obstinacy and persistence of pain, notwithstanding the trial of all milder measures.

Finally, when the case is a desperate one, and as a *dernier ressort*, every conscientious and skillful surgeon should not fail to make trial of an operation which facts prove to be as good in theory as it is successful in practice.

In conclusion, it may be said that resection of the superior maxillary nerve, together with Meckel's ganglion, for the alleviation, and in most cases the cure, of one of the most dreadful and formidable diseases to which human flesh is heir, is

one of the greatest triumphs of surgery. A careful analysis of the table will show that the two cases belonging to Wood and one to Schuppert remained free from pain at least two years; and the interesting and unique autopsy held in the case of Mike Doyle, one of the severest cases on record, has thrown much light upon the subject of accuracy in diagnosis, upon the pathological changes involved, and upon a right estimate of the untold value of this most daring operation. It is also a most significant fact that out of the twenty-one cases that have been collected from all the literature upon this subject, more than half have been performed by American surgeons. It is certainly an operation of which American surgery can justly be proud; and if the success which has attended these twenty-one cases will only induce surgeons to investigate impartially the merits of this operation, it will inaugurate a new era and establish a reform in the surgical treatment of this most desperate malady.