

## **The surgical treatment of facial neuralgia.**

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### **Publication/Creation**

New York : Wood, 1905.

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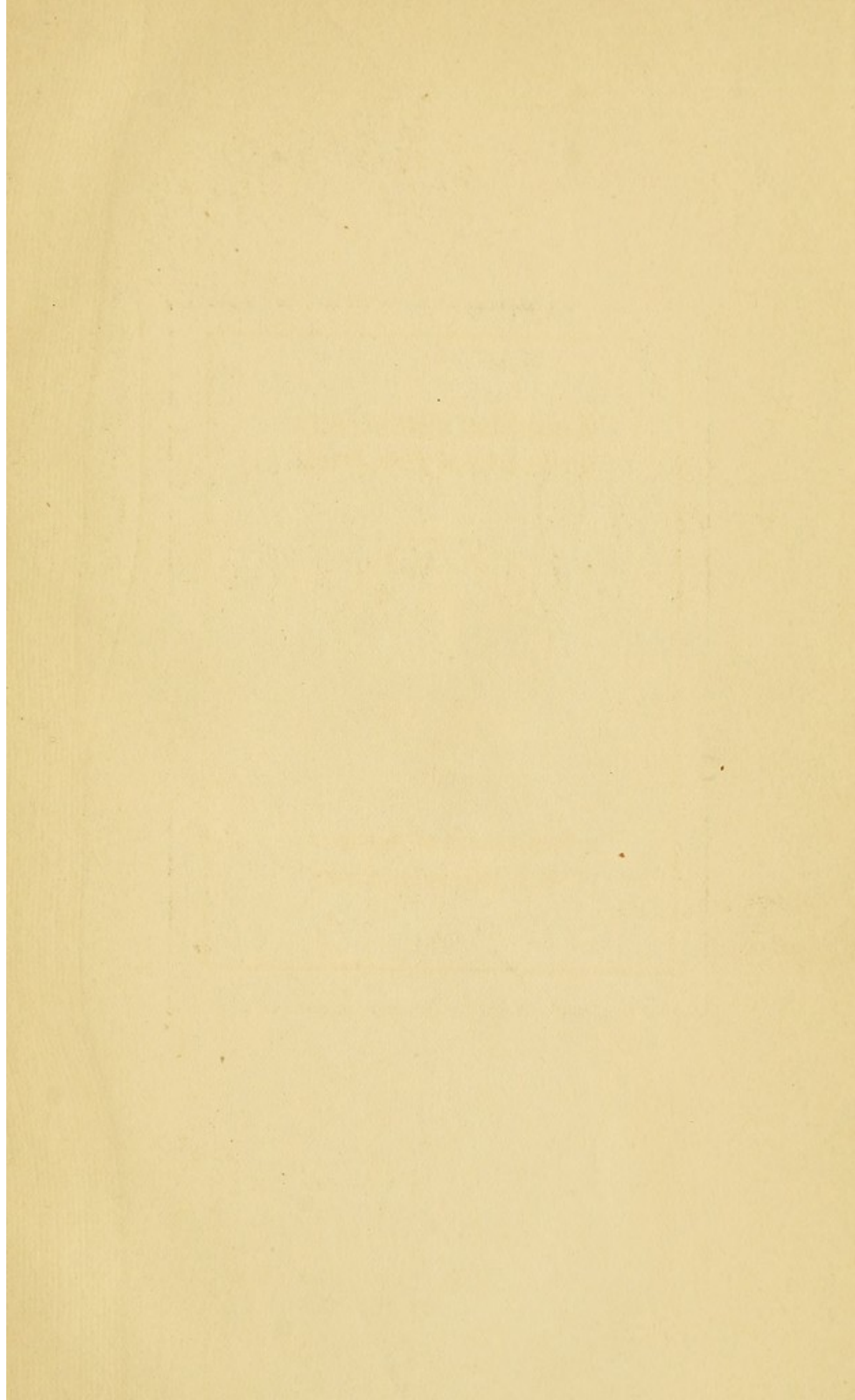
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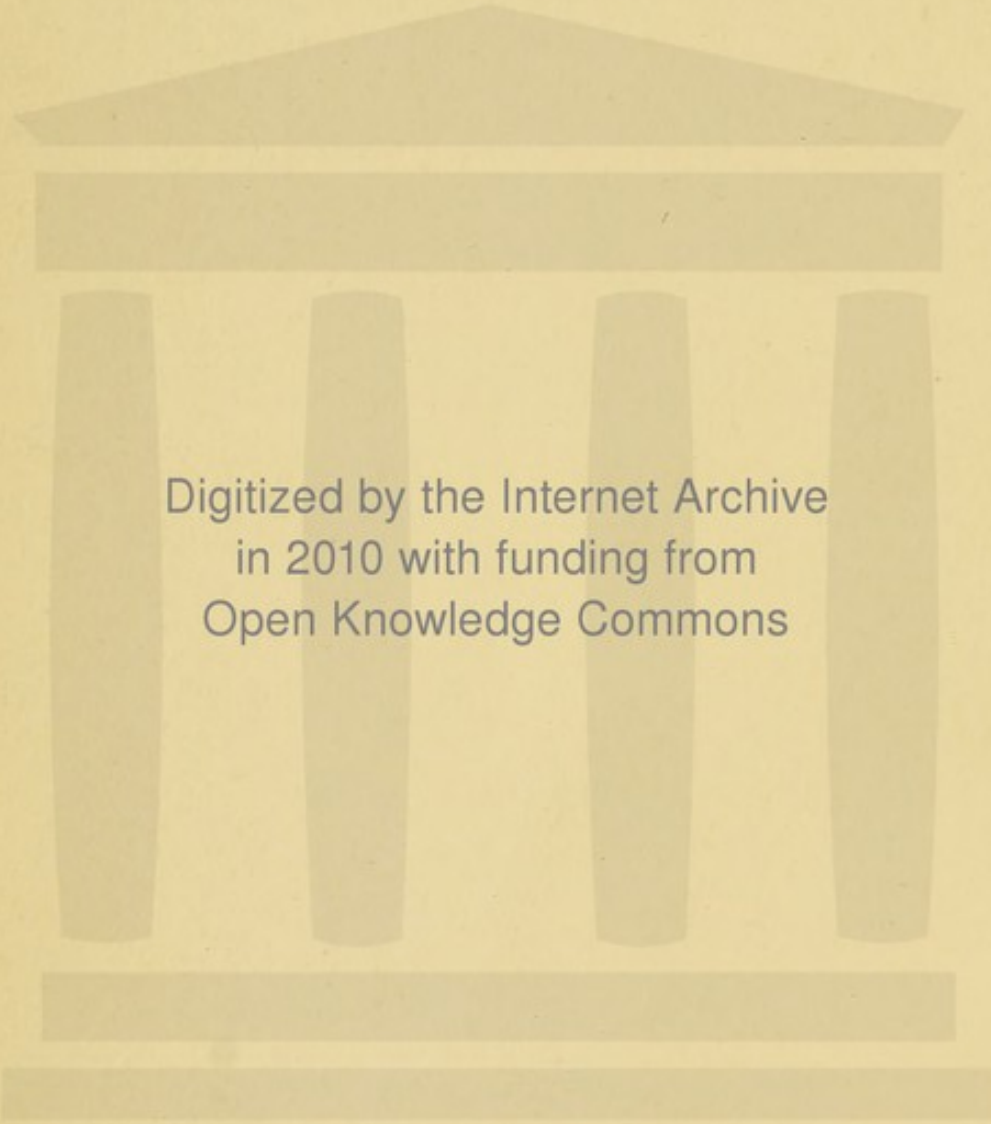
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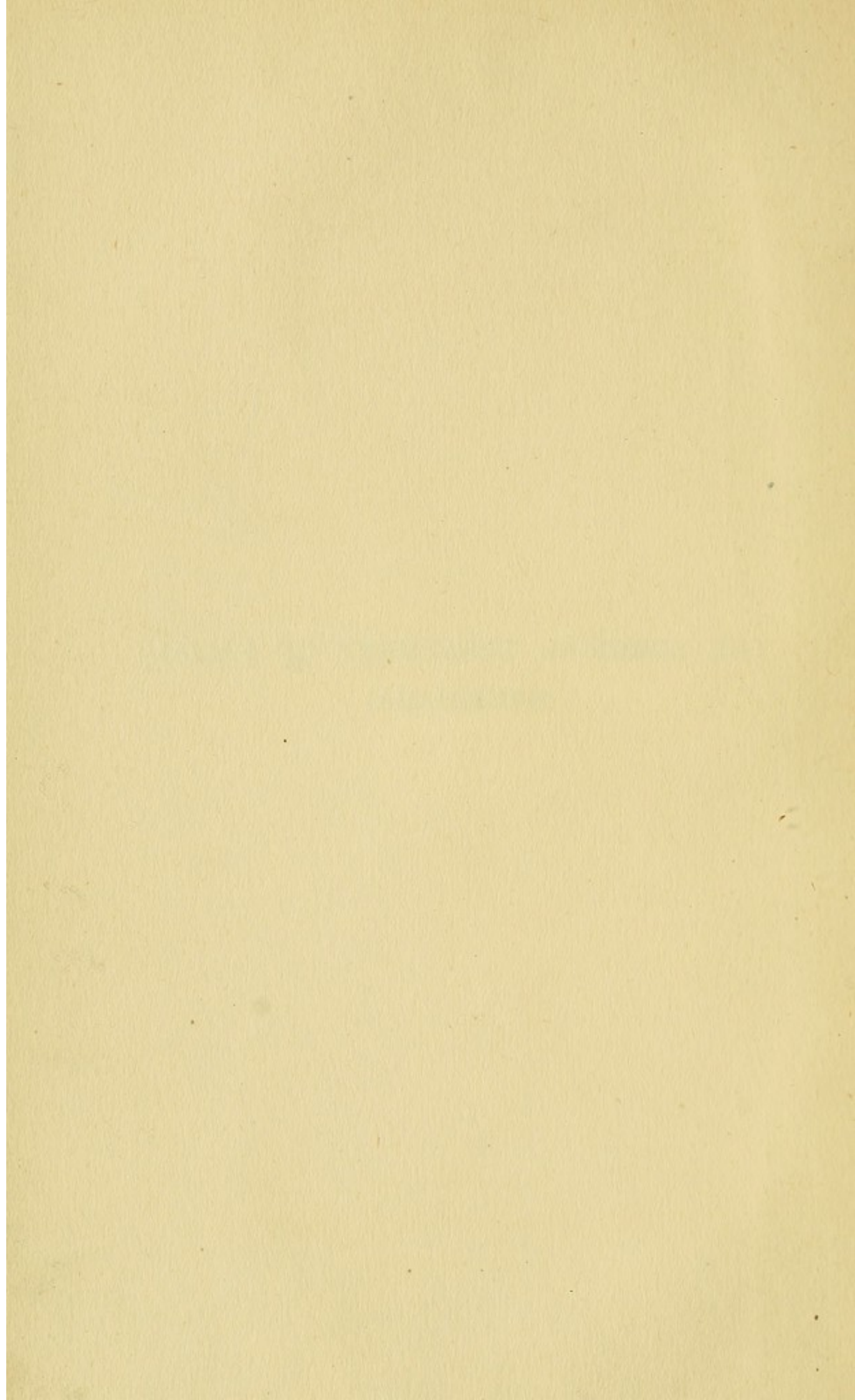




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THE SURGICAL TREATMENT OF FACIAL  
NEURALGIA.





# THE SURGICAL TREATMENT OF FACIAL NEURALGIA

BY

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NEW YORK  
WILLIAM WOOD AND COMPANY  
MDCCCCV

THE SURGICAL TREATMENT OF  
FACIAL NEURALGIA

A THESIS SUBMITTED TO THE FACULTY OF THE  
MEDICAL DEPARTMENT OF THE UNIVERSITY OF TORONTO  
IN CANDIDACY FOR THE DEGREE OF DOCTOR OF MEDICINE  
BY  
JAMES M. HARRIS, M.D.

NEW YORK  
WILLIAM BROS. PUBLISHERS  
1907



TO MY FATHER



REPORT ON

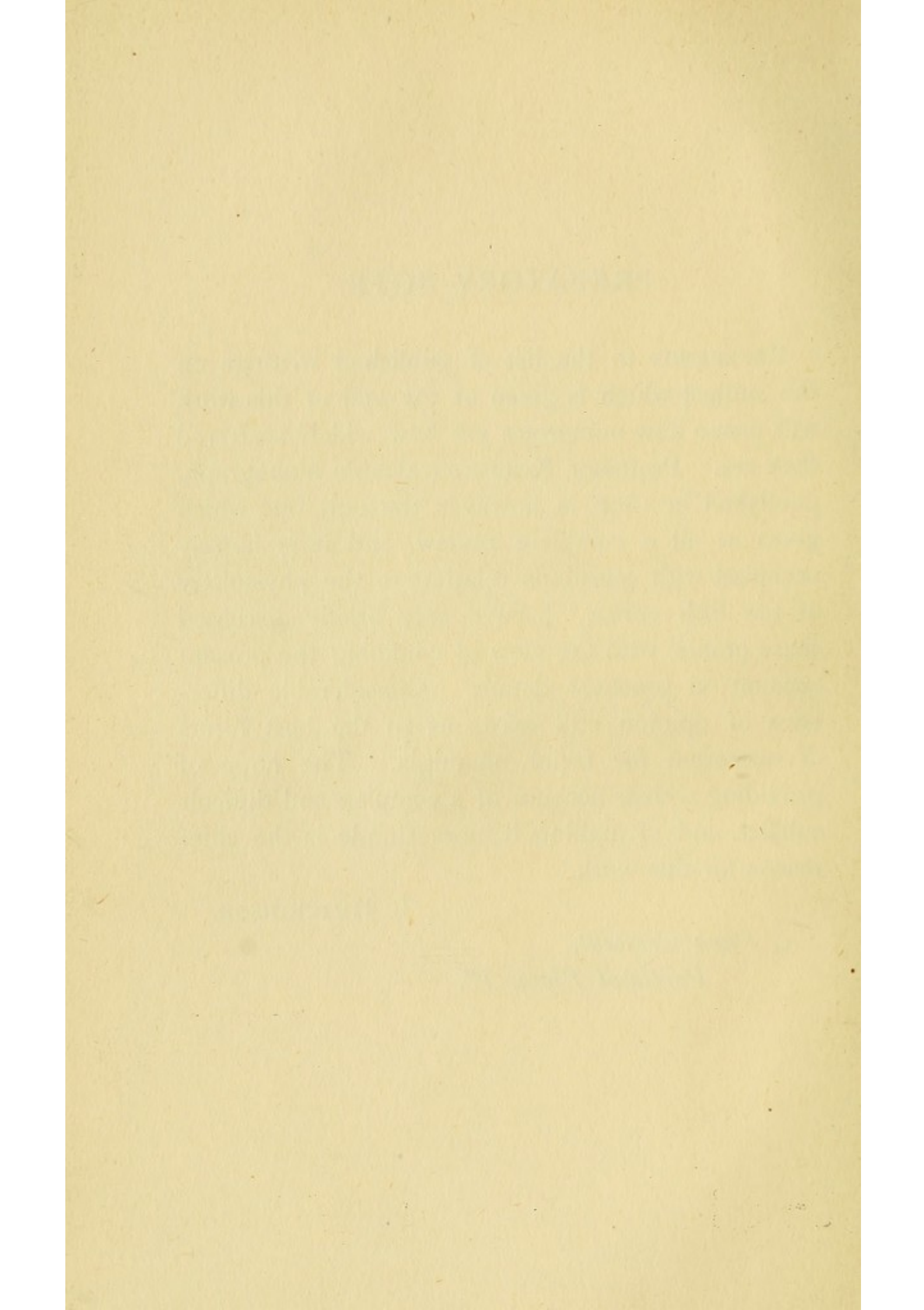
## PREFATORY NOTE.

REFERENCE to the list of published writings on the subject which is given at the end of this work will prove how numerous, yet how widely scattered they are. Professor Krause's valuable monograph, published in 1896, is, however, the only one which gives at all a complete review, and it is largely occupied with questions relating to the physiology of the fifth nerve. I have only briefly discussed these points, with the view of confining the present account to practical details. Considerable difference of opinion still exists as to the best forms of operation for facial neuralgia. The hope of providing a clear account of a complex and difficult subject, and of making it more simple is the chief reason for this work.

J. HUTCHINSON.

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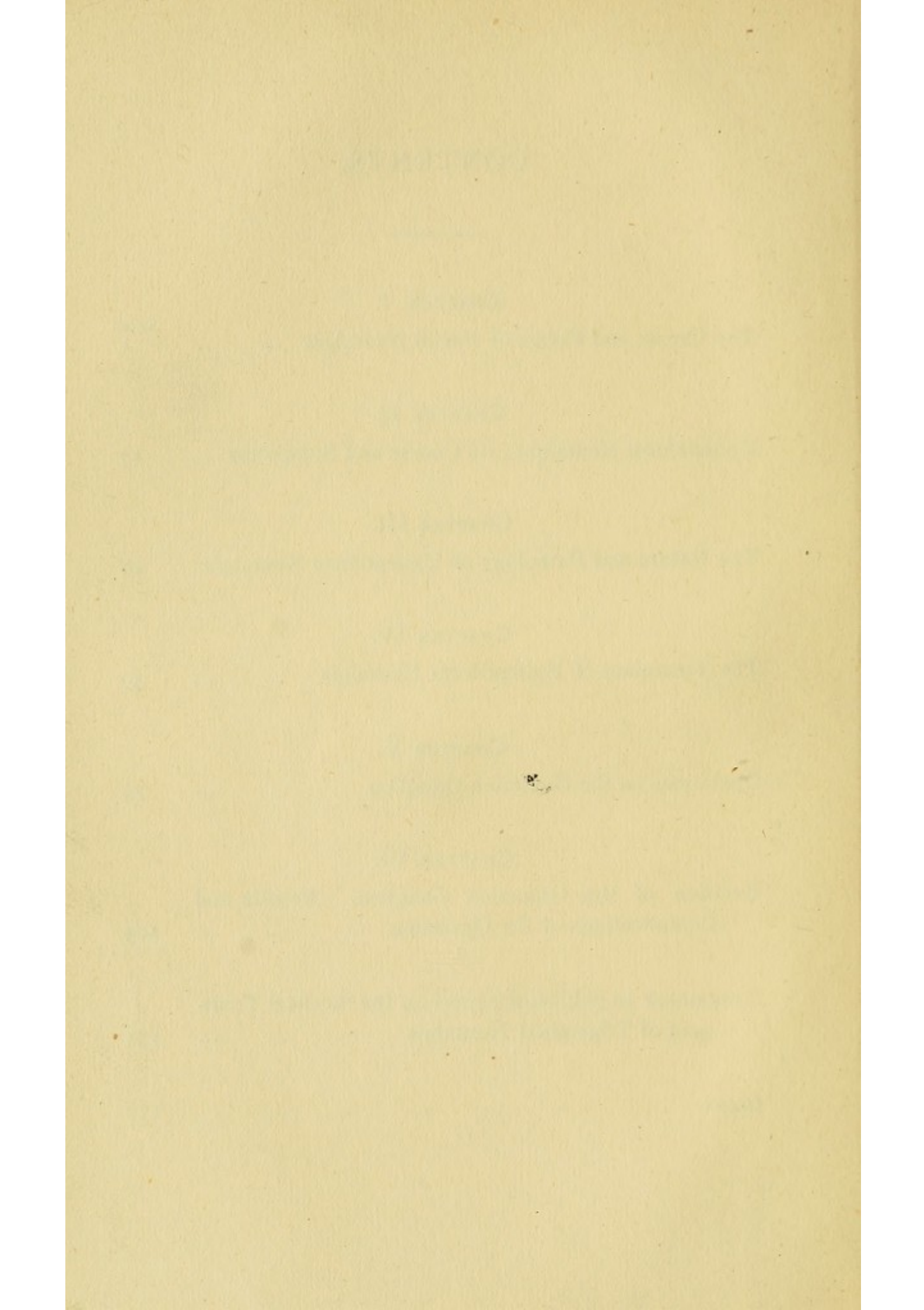
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# THE SURGICAL TREATMENT OF FACIAL NEURALGIA.

## CHAPTER I.

### THE CAUSES AND FORMS OF FACIAL NEURALGIA.

THE subject of facial or trigeminal neuralgia includes some of the most interesting problems in the whole realm of pathology and physiology. The surgeon, however, is chiefly concerned with the question : " What cases of neuralgia are suited for operative treatment, and what are the best methods to employ ? " The answer, obviously, should depend upon a scientific classification, based solely upon the causes of neuralgia ; at present such a classification is impossible. We can distinguish the pain due to errors of refraction from the more intense neuralgia set up by a peridental abscess, and the pain caused by a syphilitic node of the skull from that accompanying an attack of herpes frontalis.

Yet, of the gravest form of all, epileptiform or major neuralgia (*tic douloureux*), which now furnishes one of the triumphs of surgery, the pathology and causation are practically unknown. What



evidence exists on the subject and what theories have been devised will be briefly discussed later.

The following rough classification may be suggested :—

(1) The neuralgia due to anæmia, gout, malaria, or other abnormal conditions of the blood.

(2) That due to a neuritis, *e.g.*, the neuralgia accompanying herpes, or tabes dorsalis.

(3) The pain referred from some local cause, such as a carious tooth, an inflamed iris, a syphilitic node, &c.

The three forms of neuralgia summarised have definite causes, the removal of which is the aim of the physician or surgeon. For none of them is any operation indicated on the nerve-trunks which are apparently involved, though destruction of the terminal twigs may be occasionally indicated, as in the neuralgia due to a hollow carious tooth. Moreover, in these cases the neuralgia is favoured or induced by certain known conditions ; it is more or less continuous, or, if spasmodic, the patient has intervals of only comparative, and not complete, absence of pain.

In (4) Epileptiform neuralgia (*tic douloureux*, *neuralgia major*), neither local cause nor favouring conditions can as a rule be assigned ; the intermittent nature of the pain is kept up from first to last with shortening intervals. In this form of neuralgia any attempt of the surgeon to remove some peripheral exciting lesion is worse than useless, whilst an operation on the central part of the fifth nerve



(the Gasserian ganglion) is followed by complete cure.

Some other and less definite kinds of neuralgia of the head might be introduced, such as referred pain from visceral causes, hysterical neuralgia (closely allied to the preceding), migraine, &c., but these belong to the physician's rather than to the surgeon's province. Dr. Henry Head, F.R.S., has given a masterly account of the whole subject in Allbutt's "System of Medicine" (vol. vi.), and in Pepper's "System of Medicine" (vol. v.), it is also treated in a complete and interesting manner. Epileptiform neuralgia (neuralgia major) can as a rule be easily distinguished from the other forms after it has become well established, though in its early stages mistakes are very apt to be made. Before discussing in detail its symptoms and treatment, some of the more common varieties of neuralgia minor may be illustrated.

The neuralgia due to eye-strain from hypermetropia, presbyopia, or astigmatism, is well-known ; it is almost always frontal and ocular in distribution, and is brought on by use of the eyes in near vision. Its relief by correcting the error of refraction with suitable glasses is immediate. Iritis and acute glaucoma are often attended with more intense neuralgia, having much the same distribution. The extreme importance of recognising the reflex nature of the pain and of instituting the proper treatment for its cause cannot be over-rated.



The neuralgia from glaucoma and iritis often affects the temporal region, and, in the former case, the upper or lower jaw may be the seat of varying tenderness and pain.<sup>1</sup> Such a distribution is never met with in the neuralgia due to errors of refraction. It should not be forgotten that the latter form may be aggravated by systemic conditions. Thus, it may be necessary to treat anæmia as well as hypermetropia, &c., or the cure will be imperfect; and Dr. Head points out that in some cases in women the climacteric may share with the onset of presbyopia in inducing troublesome neuralgia.

Another important point is that eye-strain may lead to paroxysmal attacks of headache of considerable intensity accompanied by vomiting. Many a case of acute glaucoma has been diagnosed as one of "bilious headache" during the first day or two, until it was too late to save the sight by iridectomy.

It will be noticed that the neuralgia having an ocular cause is nearly always referred to the forehead. True epileptiform neuralgia hardly ever begins in the first division of the fifth (see page 17). Herpes frontalis is usually preceded by considerable pain in this nerve, and after the eruption has subsided, neuralgia may be very persistent, lasting in the worst cases for some months. It always however subsides ultimately, especially

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<sup>1</sup> Head, *loc. cit.*, p. 746.



under careful treatment. The pathology is now well established, largely owing to the work of Dr. Henry Head ; there is a definite inflammation of the Gasserian ganglion or of the ophthalmic trunk.

Another cause of severe frontal neuralgia remains to be noted, namely, catarrhal or suppurative inflammation of the air sinuses in the frontal, ethmoid, or sphenoid bones. It is not merely distension of the sinuses with pus which causes the intense pain, for an attack which clears up entirely may be attended with such severe throbbing neuralgia that at the time the presence of pus may be strongly suspected. Influenza is a fertile source of such neuralgia, as also of empyema of the frontal or other sinuses. Disease of the antrum of Highmore usually produces dull throbbing pain in the cheek, though it may extend up to the forehead, and in neglected cases the whole trigeminal area may be concerned. The grave mistake may then be made of treating the case as one of neuralgia alone, and of ignoring the real cause.

A young and healthy officer became subject to one-sided "facial neuralgia" of increasing intensity. He was then in India, and was treated in hospital with all kinds of sedative drugs without avail. Becoming steadily worse, he was invalided home to England. On the voyage he became hemiplegic, and was landed in an extremely exhausted condition. For the first time the nature of his disease was ascertained, namely, suppuration in the antrum of Highmore, from which disease of the bone had spread up to the base of the skull, with consecutive meningitis and cerebral abscess. Operative measures were unfortunately too late to save the patient's life.



Cases such as the above are very exceptional ; as Dr. Head remarks, " even in those nasal affections that cause pain, it is rarely acute enough to be spoken of as neuralgia." Suppurative inflammation of the frontal sinus, especially if its infundibular exit is blocked, and the cavity becomes distended with pus, is the most likely to produce pain of a high degree of severity.

*Headache and neuralgia due to syphilis* are of great importance, since in most cases they can be cured or greatly relieved by mercury and iodides ; moreover, their cause is often overlooked.

Their various forms and the circumstances under which they occur will be best illustrated by the following examples :—

#### I.—*Persistent Cephalalgia in the Secondary Stage from Neglect of Treatment.*

Dr. G. Schorstein and I once examined a man who was claiming damages on account of a contusion of the head, which had been followed by persistent and intense pain with loss of sleep and a torpid mental condition. The pain was largely occipital, with radiations down the cervical spine. The headache was, as a rule, worse at night, but it never left him, and his doctor had tried various sedatives without giving any relief. He complained only of this continuous ache, which had entirely prevented his working for several weeks ; in fact, he was confined to his room and looked a physical wreck. There was no optic neuritis or vomiting, but giddiness if he attempted to walk.



In making a thorough examination we found a copious blotchy syphilitic eruption, which had appeared within three weeks of the accident. Six months had elapsed, but no anti-syphilitic treatment of any kind had been attempted, nor would his doctor admit the diagnosis of syphilis. The man, however, did not get damages, but took a mercurial course instead. It may be noted that persistent headache or neuralgia occasionally results from head-injury (cerebral concussion), with or without fracture of the skull, but in this case the injury was certainly not the main cause.

## II.—*Iritis attributed to Injury. Severe Neuralgia of Head. Secondary Syphilis Overlooked.*

This case bore a strong resemblance to the one just noted. A man working in the Docks was struck by a rope which swung round his head. For four months after the accident he attended Moorfields Hospital for slight iritis in both eyes, and he also was treated by no fewer than six medical men in addition, on account of severe headache. The neuralgia was constant, but worse at night; it was chiefly frontal and vertical. During the four months the man was receiving compensation from the Dock Company, but Dr. Finlay, its medical adviser, being dissatisfied, sent the patient up to me. There was no syphilitic eruption present, nor could I obtain any history of chancre of the penis, but the evidence as to syphilis was conclusive.

It consisted in: (1) a well-marked bald patch on the dorsum of the tongue, with two small ulcers; (2) chronic enlargement of the glands in the right groin and on both sides of the neck; (3) uveal deposit from iritis in each eye; and (4) the persistent cephalalgia with characteristic nocturnal exacerbations. The man was urged to take a proper mercurial course, and I believe that his symptoms entirely subsided under its influence.



### III.—*Headache due to Periostitis and Nodes of the Skull in the Late Stages of Syphilis.*

Many examples of this could readily be quoted. In some there may be one or more definite tender swellings on the skull, accompanied by radiating pain; in others the distribution is more general, and no isolated node can be distinguished. There may be sclerosis of large areas of bone, or a node situated entirely within the cranium. Pericranial gummata are usually soft and free from tension, and therefore cause little pain, but occasionally a localised necrosis occurs beneath them. Should an abscess then form between dura mater and bone, very severe cephalalgia may be produced. Operation under such circumstances is urgently called for. As a rule, however, the symptoms yield to increasing doses of iodides of sodium and potassium or to mercurial inunction.

Syphilitic necrosis, when it involves the base of the skull, may cause intense suffering, of which the following case is an example :—

About ten years after contracting syphilis, a man became the subject of aggressive necrosis, which destroyed the whole of the palate and the nasal septum. It spread to the turbinated and sphenoid bones, until a chasm was left, through which the roof of the naso-pharynx was exposed. The disease progressed in spite of all kinds of mercurial and iodide treatment, the latter drug being the more effective, but causing considerable depression.

Piece by piece the bone of the skull came away, the separation being attended with horrible pain which destroyed



sleep for weeks together. The neuralgia was referred to both temples and to the forehead, there being little doubt that the fifth nerve about the Gasserian ganglion was affected on both sides.

This was one of the most obstinate and deplorable cases of tertiary syphilis I have ever seen. In the pre-iodide days they appear to have been common.

IV.—*Intra-cranial gummata* may cause severe neuralgia, which, as a rule, is curable by iodides.

“The anterior part of the temporal fossa is a not uncommon situation for a syphilitic gumma. In this position it causes neuralgia over the whole of the temporal fossa, accompanied by marked tenderness of the superficial structures, not only over the actual gumma itself, but over a wide area in front of it, spreading out above and in front somewhat like a fan. This area corresponds to the distribution of the ascending branches passing from the deep parts of the fossa forwards and upwards to the scalp. It does not correspond to any area or combination of areas of referred pain. . . .”<sup>1</sup>

To this observation of Dr. Head's I am able to add an explanation of the neuralgia which certainly holds good in some if not all the cases, namely, that the gumma leads by extension to an inflammation of the wall of the cavernous sinus and thus to a neuritis of the fifth nerve.

Fig. 1 shows two vertical sections through the carotid artery and cavernous sinus. On the left

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<sup>1</sup> Head, “Allbutt's System of Medicine,” vol. vi., p. 736.



side, normal for sake of comparison, the relation of the various nerves and the Gasserian ganglion are clearly shown. On the right side of the figure all traces of the cavernous sinus have disappeared; the nerves are distorted by inflammation and pressure; the carotid artery is much narrowed, and contains an organised clot, which does not block the lumen. The wall of the sinus is greatly thickened and was adherent to the temporo-sphenoidal lobe (syphilitic infiltration). The case was reported by Dr. A. H. Robinson and myself<sup>1</sup> and was, I believe, the first one published which demonstrated this pathological nature of ophthalmoplegia. Brief notes of the case are as follows:—

F. S., a man, aged 53, under care for a tertiary ulceration of one leg. In September, 1885, radiating pain came on in right temple and occiput, also in the eye. This persisted for seven months, being somewhat relieved by iodides, and having the fan-like distribution alluded to above by Dr. Head. There was also present with it complete ophthalmoplegia, which improved from time to time under iodides. In April, 1886, he contracted cellulitis of his leg from infection of the ulcer and died of septicæmia.

It will be seen from fig. 1 that all the nerves in the wall of the cavernous sinus (motor and sensory) were so inflamed and degenerated as to be almost unrecognisable as such. The apex of the temporo-sphenoidal lobe was affected with gummatous softening and was adherent to the thickened dura. It is of interest to note that, although the opposite sinus looked normal to the naked eye, microscopic examination proved that the inflammatory process had spread

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<sup>1</sup> *Ophthalmological Society's Transactions*, 1887, vol. vii., p. 250.





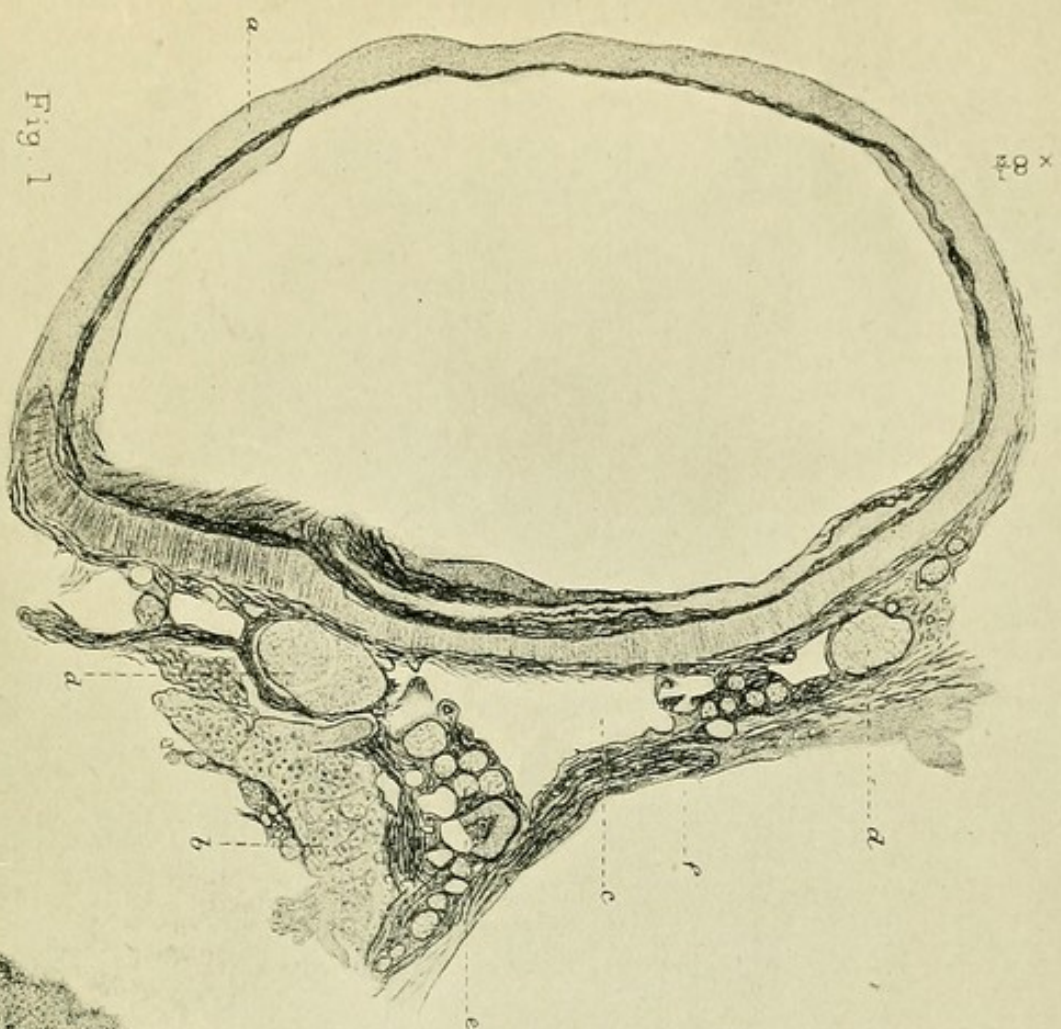
FIG. 1. (Described in the text).

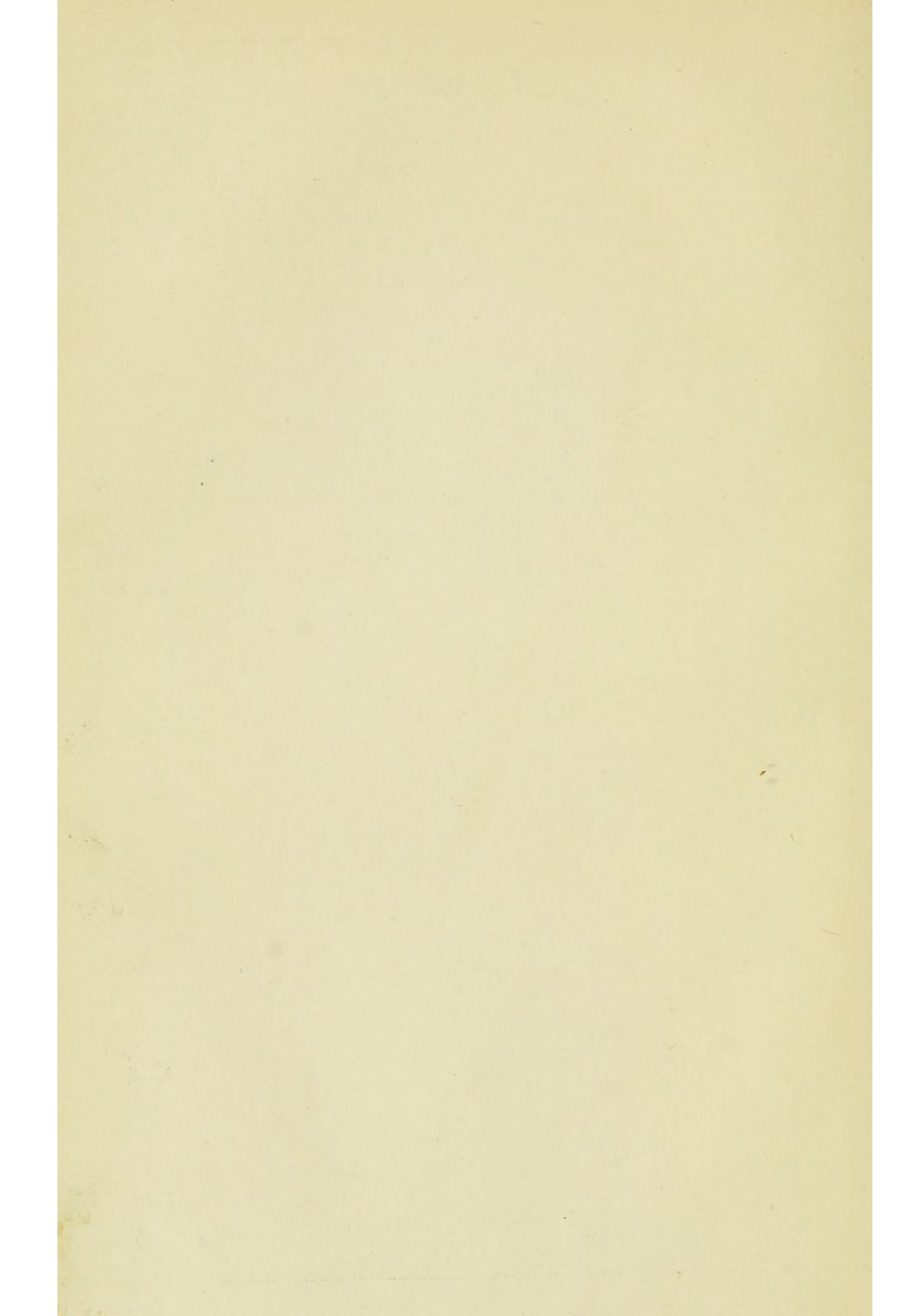
#### VERTICAL SECTIONS THROUGH NORMAL AND DISEASED CAVERNOUS SINUS.

Fig. 1. Normal section. *a* The carotid artery lined by a little *post-mortem* coagulum; *b* innermost part of Gasserian ganglion; *c* part of the cavernous sinus; *d* large nerve trunks; *e* smaller bundles of nerves; *f* dural wall of the sinus.

Fig. 2. Diseased section. *a* The carotid artery much narrowed and partly blocked by organised clot; *b* nerves distorted and much inflamed; *d* great increase of fibrous tissue, containing at parts (as at *c*), collections of round cells. Hardly any trace of the sinus itself could be detected.









across and would doubtless have produced similar paralysis had iodides not been given freely.

In the same vol. of the *Ophth. Soc. Trans.*,<sup>1</sup> I recorded an exactly similar case of ophthalmoplegia and neuralgia (fan-like distribution over the side of the head) which was entirely cured by iodides and which doubtless had the same pathology. It should be noted that in both the neuralgia was accompanied by marked impairment of sensation, thus resembling the cases due to pressure by a new growth in the region of the cavernous sinus (see p. 38). It would appear that the pain produced by tumour pressure in this region is usually more severe than that set up by syphilitic infiltration and inflammation of the nerves, though the difference may be chiefly due to the relief given by iodides in the latter class.

Inasmuch as tabes dorsalis generally occurs in those who have had syphilis, it might almost be fair to include tabetic neuralgia in the above list. But that syphilis is not the sole cause of tabes is generally admitted. The occurrence of spasmodic neuralgia in the limbs and trunk in those afflicted with ataxia is very common, and Dr. Buzzard<sup>2</sup> pointed out, over twenty years ago, the important relation that sometimes exists between facial neuralgia and tabes dorsalis. He showed that the first symptoms of tabes may be severe shooting pain in the fifth

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<sup>1</sup> Vol. vii., p. 256.

<sup>2</sup> "Clinical Lectures on Diseases of the Nervous System," 1882, p. 143.



nerve area; that the tabetic neuralgia may be followed by anæsthesia, and concurred with Pierret<sup>1</sup> in thinking that sclerosis of the descending spinal root of the fifth nerve was probably the cause. The diagnosis is a matter of much importance. Dr. Buzzard writes: "In an ordinary case of trigeminal neuralgia it is most common to find the pains limited to the district of one or more of the three divisions of the nerve. . . . But in the pains . . . which occur in the region of the fifth nerve in tabes this accurate mapping out of the district of one or other division of the nerve is not, according to my experience, observed." Too much must not, however, be made of this point, as a reference to the case on p. 122 will show. More important is the fact that true epileptiform neuralgia is always one-sided; that due to tabes may affect both sides of the head. "Flying, so-called, neuralgic pains in the head, *when they attack both sides and do not map out the district of one or other division of the fifth nerve*, should lead to attentive examination for symptoms of tabes" (Buzzard).

#### NEURALGIA DUE TO DENTAL CAUSES.

Almost everyone has had personal experience of the acute pain caused by carious teeth, alveolar suppuration and the like. Although the cause may

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<sup>1</sup> "Essai sur les Symptomes Céphaliques de Tabes Dorsalis." Paris, 1876.



be limited to one tooth, the neuralgia is frequently wide-spread, and may be paroxysmal in character, though very rarely epileptiform in the sense of having intervals of complete relief. Besides the two common and easily recognised causes just mentioned, there are others, such as acid fermentation around the neck of a tooth, ulceration of gums (sometimes due to mercurial stomatitis), caries or necrosis of bone set up by injury in tooth-extraction, or the crowding out of the wisdom teeth. A very severe neuralgia may be set up in the following manner : a hollow tooth is stopped with a heavy metal stopping before the cavity has been thoroughly disinfected or the nerve destroyed. In such cases weeks or months of suffering may ensue, only to be relieved by the removal of the stopping or the extraction of the tooth.

Without doubt, the worst and most persisting cases of dental neuralgia may simulate *tic douloureux*, and even lead to the discussion of operation upon the fifth nerve ; but careful examination of the teeth and gums, and consultation between dentist and surgeon, should guard against either of two errors being committed. The first is one too commonly made, namely, the useless extraction of normal teeth in cases of true epileptiform neuralgia. The second is less apt to occur ; the performance of neurectomy, or even excision of the Gasserian ganglion, in a case where dental extraction, &c., would suffice.



In the foregoing account of "minor neuralgia" the treatment required has been indicated by the varying causes, but in a considerable proportion of cases no cause can be definitely assigned. For these, empirical measures may be of use, the following being a selection from the ever growing list of such remedies.

### I.—*Internal Treatment by Medicine.*

The importance of *iodides* (potassium, sodium, and ammonium) in cases having a syphilitic origin is obvious. They may possibly be of advantage in a few other cases, from their influence in lowering blood-pressure, but the depression they are apt to cause is a drawback to their use.

*Quinine* has a great reputation, and amongst the preparations of it may be mentioned the valerianate (in 5-grain doses), the hydrobromide (2 to 5 grains), and the salicylate (5 to 10 grains). The hydrobromide may be given hypodermically.

*Cannabis Indica* (in doses of one-fourth to one grain) is a more dangerous drug, and should be resorted to only in severe and special cases. In a few cases it appears to be the only remedy which relieves, though its toxic effects may be as bad as the disease for which it is given.

The same objection applies to *Gelsemium* (five to fifteen minims of the tincture). Sir Victor Horsley states that poisonous doses of this drug, in his



experience, have alone relieved true epileptiform neuralgia.

*Citrate of caffein* is comparatively harmless, but only does good in slight cases of neuralgia; *aconite* preparations are dangerous and rarely successful; bromides depress and are of little use.

*Morphia* will always check pain, but most will agree with Prof. Krause in holding that it should be entirely banished from the therapeutics of neuralgia, as from those of intestinal obstruction. The only exceptions, in the former case, are those where the cause of the neuralgia can be recognised and removed, (*e.g.*, a carious tooth) but some temporary alleviation is required for the intense pain.

Its use in epileptiform neuralgia is a grave blunder, or worse. Ever-increasing doses are required,<sup>1</sup> and the patient becomes both a mental and physical wreck. The operation which will alone cure him is deferred, and the patient becomes less and less fit to undergo it.

## II.—*Local Treatment of the Nerves and Skin.*

The inunction of various sedatives may be useful—such as equal parts of mesotan (a derivative of salicylic acid) and olive oil, menthol and oleic acid, the unguentum aconitinæ, etc.

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<sup>1</sup> In one case recorded by Prof. Billroth, the patient, before the end came, was taking nearly half-an-ounce of morphia hypodermically every day!



Freezing the skin with chloride-of-ethyl spray has been recommended, but is more likely to do harm than good.

Galvanism and electricity in all forms have had a wide trial, but all that can be said is that they are occasionally useful.

The application of warm dry heat is sometimes efficacious.

The hypodermic injection of osmic acid into the nerve-trunk chiefly concerned is most uncertain; it may be put on a level with nerve-stretching in being sometimes of temporary benefit. A 2-per-cent. solution is usually employed, and the attempt made to hit the nerve-trunk with the point of the syringe-needle before the injection is made. The writer has no personal faith in the method.



## CHAPTER II.

### EPILEPTIFORM NEURALGIA ; ITS COURSE AND SYMPTOMS.

THE disease to be discussed is also known by the scientific name of neuralgia quinti major and by the inexact but familiar term of tic-douloureux. As the latter is often used to include cases of minor neuralgia it is best to discard it entirely. It is important to define the class "epileptiform neuralgia" as closely as possible, since in it alone are the important operations on the Gasserian ganglion indicated. Whilst examples of it are frequently mistaken in the earliest stage of the disease, difficulty can rarely arise when it is well established. The chief features of true epileptiform neuralgia are as follows:—

- (1) It is almost invariably unilateral.
- (2) It commences in the distribution of either the second or third division of the fifth nerve, and tends to involve both to the same extent.
- (3) The first (ophthalmic) division, so frequently concerned in cases of minor neuralgia, is involved comparatively little in epileptiform neuralgia. Radiations of pain in the ophthalmic distribution



and that of the cervical nerves often, however, occur.

(4) The attacks of pain are paroxysmal or spasmodic and tend to steadily increase in severity, whilst the intervals of freedom from pain shorten.

(5) During each attack there is usually spasm of the facial muscles on the affected side.

(6) No cause can, as a rule, be assigned for the onset of the disease, but talking, eating, or exposure of the skin to slight cold or light pressure, invariably bring on the attacks when the disease is well established.

(7) The subjects of the disease, at its onset, are usually adults between the ages of 30 and 50. Males are more often the subjects of it than females.

(8) Its progress is one of steadily increasing severity, lasting an indefinite number of years.

Spontaneous cure is almost unknown.

(9) Medical treatment, except increasing doses of morphia, has little or no effect. All kinds of operations on the peripheral branches of the fifth nerve may give temporary relief.

(10) Partial or complete removal of the Gasserian ganglion alone affords a permanent cure.

The summary given above will render unnecessary a detailed account of all the symptoms, which has been admirably given by Dr. Head<sup>1</sup> and other writers, such as Professors Krause and Trousseau.

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<sup>1</sup> Dr. Clifford Allbutt's "System of Medicine," vol. vi., pp. 28 to 233.



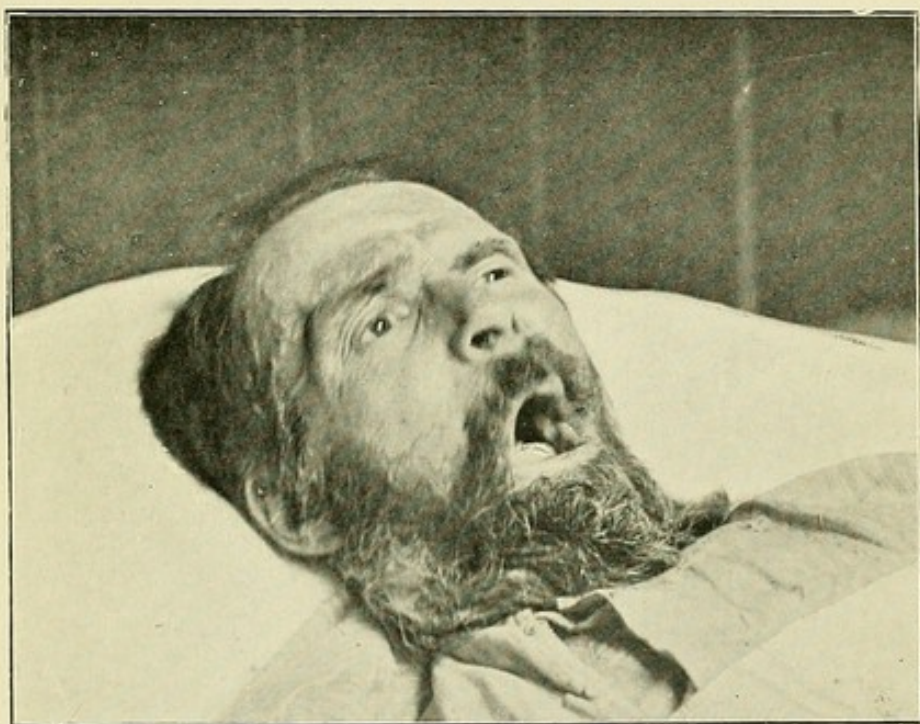


FIG. 2.

From photograph taken during a severe and typical attack of trigeminal neuralgia. The left fifth nerve was concerned, but it will be noticed there is convulsive spasm of the facial muscles on the right side as well as of the depressors of the lower jaw. The temporal artery becomes prominent during an attack. The expression of agony is fairly well conveyed in the reproduction.





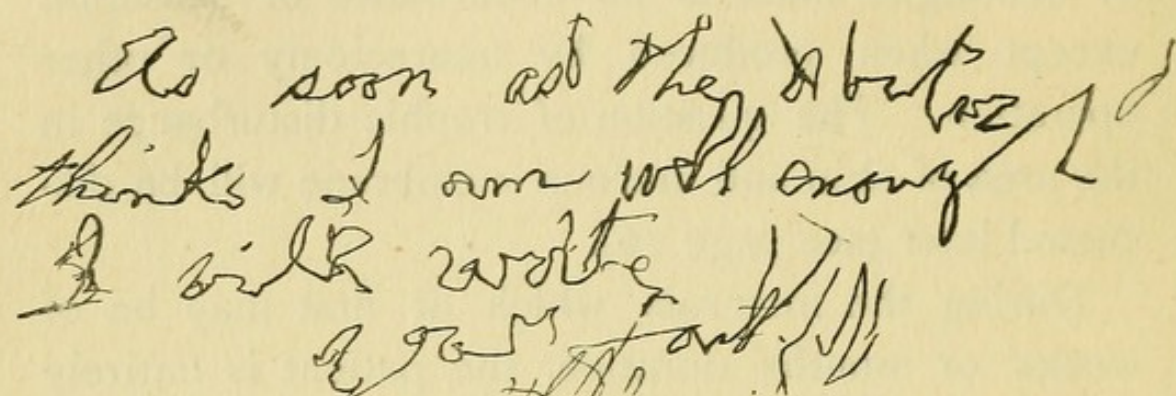
One of its most striking features is the strictly unilateral nature of the complaint ; two exceptions only to this rule are mentioned by Krause and Head, in the latter case the neuralgia had lasted twenty-five years. However long the duration of neuralgia, there is no disturbance of sensation except when produced by neurectomy or other operation. The question of trophic disturbance in the area of skin and mucous membrane will be discussed later (see page 26).

During the intervals, which at first may be of weeks' or months' duration, the patient is entirely free from pain ; in this respect a marked contrast exists to most cases of minor neuralgia. In advanced cases, however, the attacks occur with only a few minutes' interval. Touching the skin lightly with a handkerchief or feather at first may produce an attack ; later, the act of mastication or the attempt to talk will bring it on. Night and day the paroxysms occur ; so that, from loss of sleep and impaired nutrition, the patient's condition becomes an utterly miserable one. Billroth graphically pictures such a case : " I can see him now before me, emaciated to a skeleton, with a rigid, staring expression, with the saliva dribbling from his open mouth, with white, neglected beard and long, unkempt hair." It is no wonder that such sufferers seek relief in suicide, or, what is almost as bad—the morphia habit.

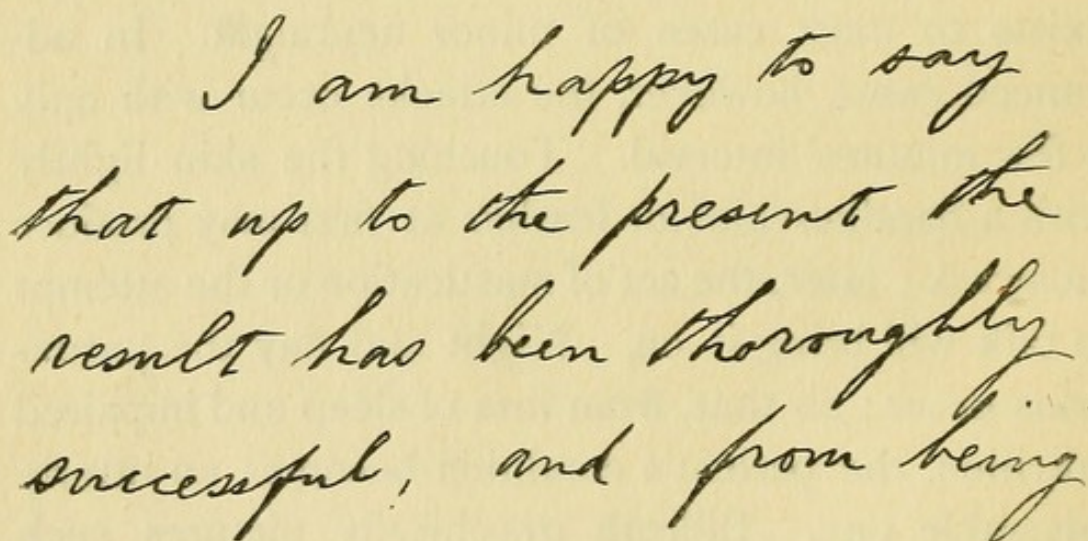
Fig. 3 illustrates the state of mental degradation



which was induced in one of my cases by his prolonged suffering and abuse of morphia. The upper specimen of hand-writing was written by the patient (a man of about 50), in answer to the strong appeal to undergo the radical operation. It was the best



As soon as they ~~about~~  
 thinks I am well enough  
 I will write  
 A good night



I am happy to say  
 that up to the present the  
 result has been thoroughly  
 successful, and from being

FIG. 3

attempt at writing he could do, and the contrast with his natural hand a year after the operation is most striking.

Cases of suicide directly due to epileptiform neuralgia are by no means rare, and are charitably referred to temporary insanity. We may, however,



fairly ascribe this nervous instability and loss of mental control to the agony so long endured, the want of sleep and rest, and to the grave effects of drug-treatment. Perhaps the depressing effect of many futile operations must also be taken into account. Thus it will be seen there is no reason to suppose that a tendency to insanity or perverted mental action can indirectly cause the neuralgia; it is far more probable that the reverse takes place. Epileptiform neuralgia is confined to no class, age, or rank in life. Some of its sufferers are men and women of the highest intellect, of the strictest lives; others have never worked hard except with their hands, and many have lived freely as regards alcohol and the like. The disease would appear to be especially prevalent in the United States, but almost every European country seems to furnish its quota of sufferers. It would be, however, a matter of great interest to ascertain its relative prevalence in India and other tropical countries; it may be found that it is mainly confined to those having a temperate or cold season.

The local distribution of the neuralgia in epileptiform cases is of much importance as an indication of the form the operation should take. Analysing sixteen cases operated on by Italian surgeons, we find that all three divisions of the fifth nerve were involved in only four (25 per cent.). In the other twelve cases the second division (superior maxillary) was alone concerned in two cases, the third



in one, whilst in the remaining nine (60 per cent. of the whole number) the neuralgia affected both the second and third divisions. It is, therefore, obvious that in 75 per cent. the surgeon had no reason for attempting division of the ophthalmic trunk, as removal of the lower part of the ganglion would suffice for a cure. Professor Billroth, who had much experience in the treatment of facial neuralgia, noted that the nerve affected in the majority of cases is the superior maxillary division. Sir Victor Horsley observed the same fact, and states that in every case in which a dental origin could be assigned for typical trigeminal neuralgia the upper jaw was the one concerned.

It should, however, be clearly stated that true epileptiform neuralgia rarely has such an origin, though it is hardly necessary to recommend that the condition of the teeth and gums should be seen to in any case of facial neuralgia. All carious teeth should be carefully stopped, or, if that is found impossible, they should be extracted. Sometimes a heavy metal stopping is the cause of intense neuralgia, and septic changes are only too apt to occur under an elaborate crown or bridge of gold, and to cause this symptom. But, as a rule, too much attention is paid by the physician to the teeth in cases of epileptiform neuralgia. Nothing is more certain than that it may arise in patients with no trace of dental caries or irritation, and that the extraction of healthy teeth is a useless and



barbarous method of treatment. In every case in which I have operated on the Gasserian ganglion a number of such teeth had been previously removed without the slightest benefit. Such a measure cannot be too strongly condemned.

Spasm of the facial muscles is rarely absent, at any rate during the severe attacks ; it is illustrated by fig. 2 taken from one of my cases.

Dr. Head notes that in addition to the reflex spasm of the facial muscles there may be fibrillary tremor. The liability of the patient to the attacks, when once started, continues as a rule during the remainder of his life, unless a curative operation is performed. Billroth observed one case of spontaneous subsidence, but it is almost a solitary exception to the rule. It hardly ever commences before the age of 30 or 35, often later. In both these respects a striking contrast is afforded to migraine and true epilepsy (which are also paroxysmal diseases of the nervous system) ; both as a rule develop in early life and tend to gradual diminution or disappearance after the age of 50. By some observers migraine is held to be a form of neuralgia which is practically confined to the ophthalmic division of the fifth nerve, and possibly started by exposure of the supra-orbital regions to cold.<sup>1</sup> In its distribution, the age of its onset, and its tendency to cure, it differs completely from epileptiform neuralgia.

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<sup>1</sup> Anstie, Sinkler, &c.



*Has epileptiform neuralgia any relation to true epilepsy?* — Trousseau discusses this point and mentions two cases in which the diseases co-existed, but this does not take one far. He was evidently unwilling to admit their close relation, and rightly so; but he wrote that, if it proved that the family histories of the subjects of epileptiform neuralgia revealed “neuroses,” he would have to bracket the two. The evidence hitherto collected shows that the sufferers from true epileptiform neuralgia can neither blame their immediate ancestors for nervous bequests, nor themselves with contributing self-indulgence in their habits of life. Epileptiform neuralgia has no apparent relation to the use of alcohol or tobacco, to syphilis, to gout, perhaps not even to that vague entity, “the rheumatic tendency.”

Sir V. Horsley, in enumerating the possible causes, attaches most importance to three—alcoholic excess, traumatism, and dental or peridental inflammation. The opinion of such an authority deserves the highest respect, but cases of true facial neuralgia of unsurpassed intensity are met with in those who (1) have been teetotalers all their lives, (2) have sustained no injury whatever to the head, and (3) have never known the pangs of toothache.

The late Dr. Anstie made the interesting suggestion that in the subjects of epileptiform neuralgia there was apt to be associated the taint of insanity. In many of the recorded cases the patients before operation are described as being strange in their



manner, perhaps threatening suicide, or actually delirious, whilst delirium has sometimes come on immediately after the operation ; but these symptoms of mental derangement are probably due to prolonged suffering and loss of sleep. There is really no evidence of the connection between epileptiform neuralgia and any neurosis ; the disease stands by itself. In the next chapter will be discussed the question of its pathology.



### CHAPTER III.

#### THE NATURE AND PATHOLOGY OF EPILEPTIFORM NEURALGIA.

IT is improbable that the typical epileptiform neuralgia, for which operations on the Gasserian ganglion are so successful, depends upon a true neuritis. The intervals of complete freedom from pain, which early in the case may be of many weeks' duration, and the fact that neither motor paralysis nor cutaneous anæsthesia ever attends the neuralgia however inveterate, place the affection in an entirely different category from the well-known peripheral neuritis of the limbs. It is true that some symptoms which might be termed trophic (such as œdema, persistent congestion, or dermatitis) are occasionally met with in the regional distribution of the intense epileptiform neuralgia, but traumatic irritation by the patient in the hope of obtaining some relief is the usual cause of such symptoms. In several of my cases the patient during each spasm of pain used to violently grasp at the skin involved as though to tear it away, and no wonder such a habit led to some "trophic" effects.

W. W. Keen states that he has seen two cases of corneal ulceration and opacity in conjunction with



trigeminal neuralgia, but on reference to his notes of these cases one finds no record whatever of eye-trouble in one of them; in the other, the eye concerned had been the subject of chronic glaucoma, and the lens had already been removed! I know of no other instances in which the neuralgia was associated with trophic changes in the eye, and obviously Keen's cases prove nothing. It is of course well known that herpes frontalis and nasalis may be attended with conjunctivitis and corneal ulcers, sometimes even with sloughing of the eye. In herpes the existence of a neuritis involving the Gasserian ganglion has been proved, and the fact that eye changes never occur in paroxysmal neuralgia of the fifth nerve is a strong argument against the latter being due to neuritis.

It is true that Spiller, who examined the nerves and ganglia in several cases, described globular degeneration of the myelin-sheaths, but this is no proof of inflammation, and moreover, he admits that the same changes may be found in other nerves which are not the seat of neuralgia. Spiller also described thickening of the arterial walls in the Gasserian ganglion, swelling of the axis-cylinders, &c. Keen considers that true pathological changes were proved in six out of seven cases examined by Spiller, but, as in excision of the ganglion it is impossible to avoid a somewhat rough handling of the delicate nerve-structures, this statement must be accepted with great reserve. Peculiar staining



methods are also responsible for some of the changes which have been found. This does not, of course, apply to diseases of the blood-vessels in the ganglion (such as extreme narrowing of their lumen). It is doubtless true that arterio-sclerosis has been occasionally found, but that it is often present in connection with epileptiform neuralgia is certainly not the case. How, then, can it be the cause of such neuralgia if it only exists in a small minority of the cases? Again, typical epileptiform neuralgia is met with at an age when arterial sclerosis hardly occurs; in thirteen cases out of thirty-two it commenced between 30 and 40 years—Billroth.

I believe the theory of vascular degeneration as the chief cause, or even as a cause, of trigeminal neuralgia should be entirely rejected. It is more difficult to disprove the theory of spreading neuritis, which has the strong support of Sir Victor Horsley,<sup>1</sup> who regards "true neuralgia" as being synonymous with neuritis, and suggests that the inflammation often commences in the small dental nerves, and spreads up along the larger branches to the Gasserian ganglion.

Horsley, however, admits that the only changes in the peripheral branches he has ever found, consist in thickening of their fibrous-tissue sheaths; that the nerve-tubules are normal, and further, that the Gasserian ganglion shows no changes except a varying degree of adhesion to its dural investment.

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<sup>1</sup> Horsley, *Clinical Journal*, 1897, vol. xi., pp. 8 and 17.



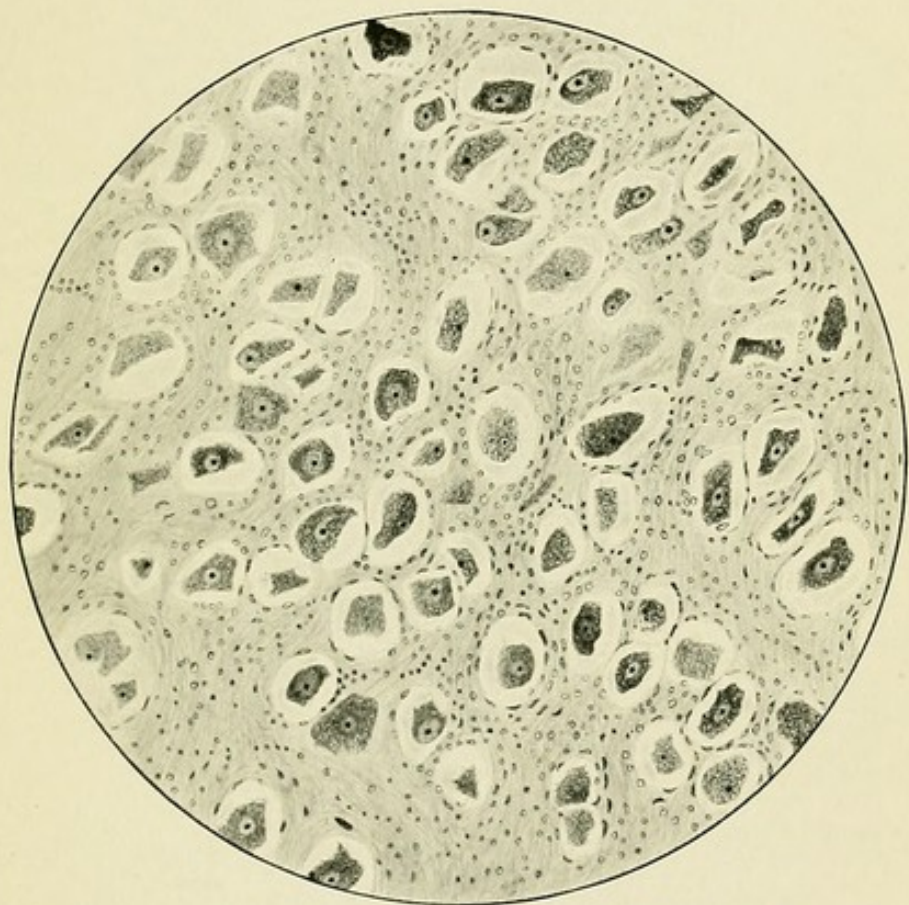
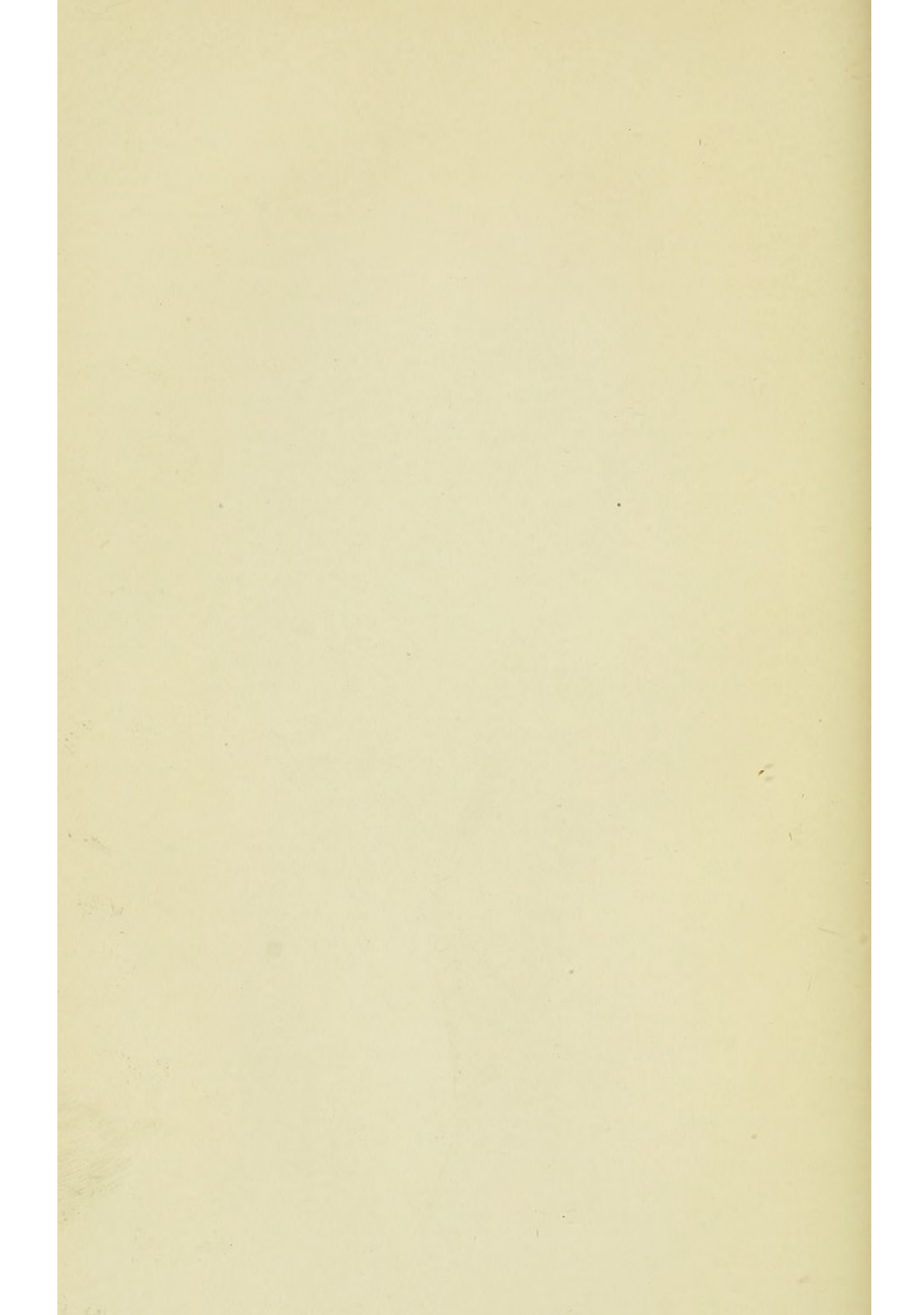


FIG. 4.

Section of Gasserian ganglion removed from case of inveterate trigeminal neuralgia. The ganglion cells are seen to be perfectly normal.





Spiller and Keen, on the other hand, attach importance to degeneration of the myelin-sheaths of the nerves, whilst Billroth states that microscopical examination of the excised peripheral nerves proved in so many cases absolutely negative that it was given up as useless.

Schwab examined two Gasserian ganglia which had been extirpated, the operation following others which had been performed on the peripheral branches of the fifth nerve. He found slight changes in both ganglia, but in neither case did he regard them as sufficient to account for the neuralgia. However, he attributed the neuralgia to one of three causes, a peripheral neuritis, an interstitial inflammation of the ganglion itself, and a neuritis of the sensory root of the ganglion, of which, he says, there are two instances recorded. It is very doubtful whether any such changes are really present. Amongst those who have recorded entirely negative results from thorough examination of the removed ganglia may be mentioned Monari,\* Codivilla (three cases), myself (specimens examined by Dr. Henry Head, F.R.S.), and Dr. J. Crawford Renton. Prof. Krause's observations on both peripheral nerves and ganglia, resected for trigeminal neuralgia, have also been negative, and he suggests that "perhaps the changes escape our detection because they are molecular."

Fig. 4 represents a section through the ganglion

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<sup>1</sup> Monari, *Beiträge zur Klinische Chirurgie*, Band xvii., 1896.



from one of my cases. It shows well the ganglion-cells and supporting connective tissue. It will be seen that the ganglionic cells are in no way compressed; the fact that they differ much in size is due to the section cutting through some at their centres, and others at the periphery. The minute cells of the neuroglia are not more numerous than is normal, and nowhere is there the slightest evidence of inflammation. In fact, the section might be taken to illustrate the normal structure of such a ganglion.

Fig. 5 is taken from a section through one of the main branches of the fifth nerve just beyond the ganglion, also from a case of inveterate trigeminal neuralgia. The dense fibrous sheath is perfectly normal, as are also the nerve-tubules. Attention is drawn to a small artery cut across in the nerve; its wall is in no way altered from the normal.

It may therefore be taken as proved that in many cases of epileptiform neuralgia of long duration the Gasserian ganglion and its main branches show no pathological change, and that the disease has, moreover, no relation to impaired blood-supply due to arterial narrowing, &c. The few observers who have described abnormal appearances in microscopic sections from such cases vary much in their accounts.

These facts lead one to the conclusion stated on p. 1, that the pathology of epileptiform neuralgia is still unknown.



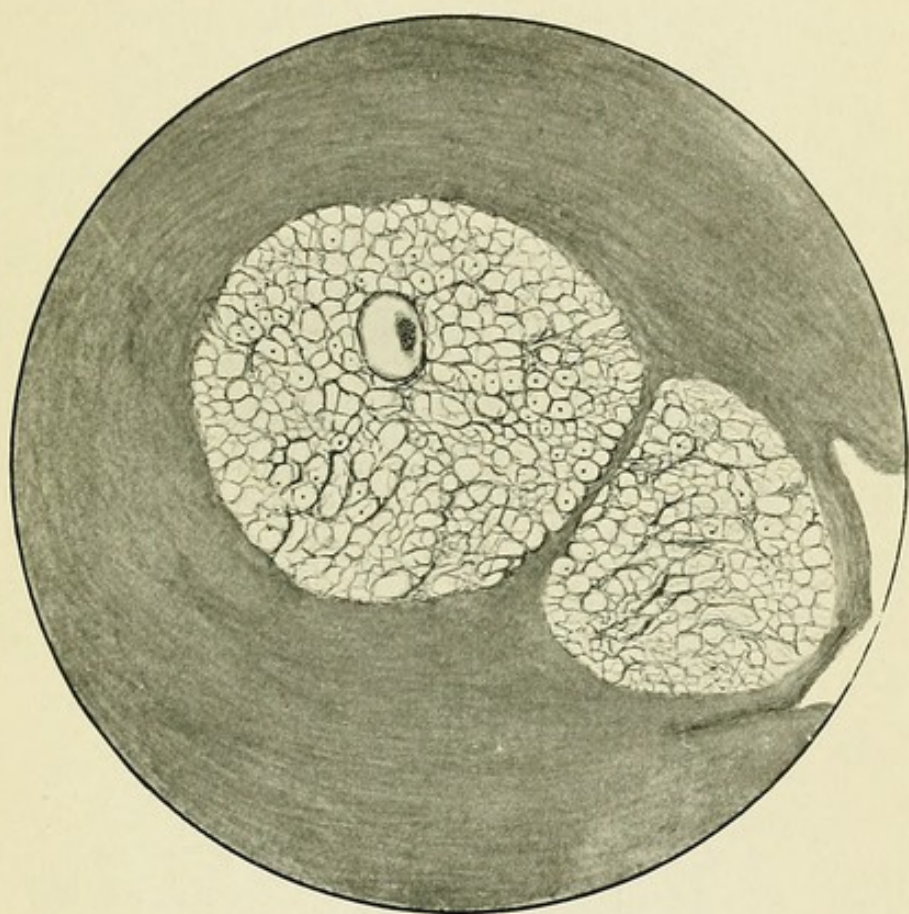


FIG. 5.

Section through a main branch of the fifth nerve, from a case of epileptiform neuralgia.





We will now consider, as throwing some light upon the subject, the question of tumours involving the Gasserian ganglion.

Cases illustrating this, though very uncommon, are yet of special interest; they afford the clearest evidence of a central origin for neuralgia of the fifth nerve, and in some instances the pain closely resembles that of "idiopathic" epileptiform neuralgia. Almost always, however, there is evidence of pressure on the neighbouring nerves, the carotid artery, or the cavernous sinus, with marked anæsthesia, and the diagnosis of tumour can usually be made before the operation. The following is a brief account of the chief recorded cases of the kind:—

A man, aged 50, was sent to me by Dr. Henry Head, with partial oculo-motor paralysis on one side, severe neuralgia of the corresponding fifth nerve, and partial anæsthesia. An exploratory operation by the temporal route showed an extensive ossifying chondroma or chondro-sarcoma growing from the apex of the petrous bone and invading the Gasserian ganglion. Partial removal of the growth was alone possible, the patient recovering from the operation.

Kosinski,<sup>1</sup> in a case like the preceding one, attempted a complete removal of the tumour, but

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<sup>1</sup> Kosinski in Chipault's "Chirurgie Nerveuse," vol. ii. p. 195.



with fatal result. His patient was a woman, aged 53, whose right eye was atrophied, and in whom the right facial and trigeminal nerves were paralysed. A tumour could be felt in the right nasal cavity. The upper jaw on that side was resected, and a tumour growing from the base of the skull was removed; it penetrated into the cranial cavity. At the autopsy the tumour was found to have been only partially removed; it was an osteo-sarcoma and was said to have started from the Gasserian ganglion itself. This, however, must have been a mistake; it was connected with the sella turcica, the sphenoidal sinus, and the bone forming the anterior lacerated foramen. It is obvious that it was impossible to remove such a growth, and it is inconceivable that an osteo-sarcoma should start in the Gasserian ganglion itself.

This was, however, the origin of a tumour described by R. W. Smith as a neuroma, but which should rather be termed a true sarcoma. The case was of such interest that the drawing and description are here reproduced<sup>1</sup> (see fig. 6).

“In this instance the tumour implicated the Gasserian ganglion, and was the source of more severe and uninterrupted suffering than I have ever witnessed either in this or any other affection.

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<sup>1</sup> R. W. Smith's "Monograph on Neuroma" was published in 1849, and reproduced in 1898 by the New Sydenham Society. This case was probably one of the first recorded of tumour of the Gasserian ganglion.

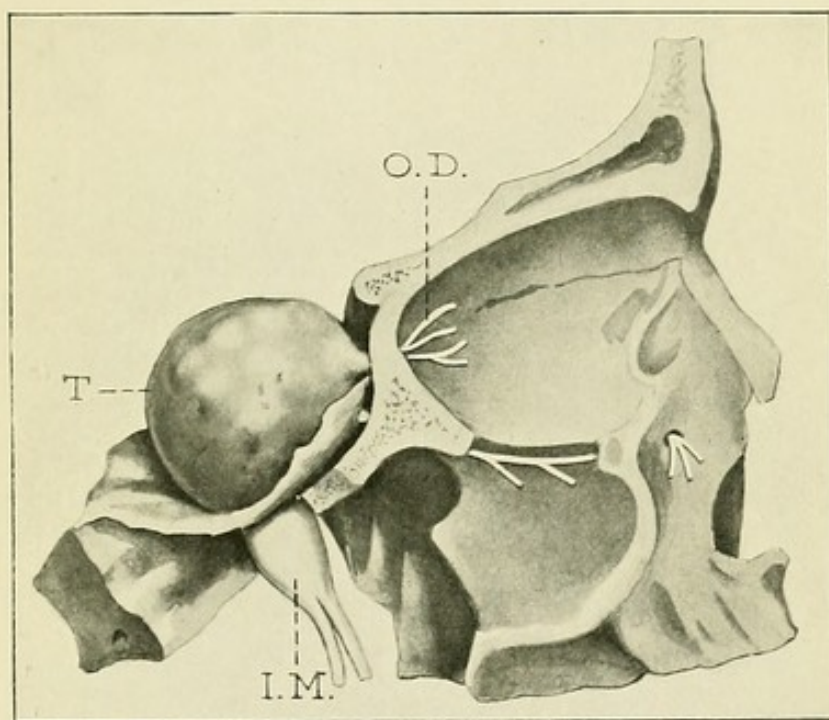
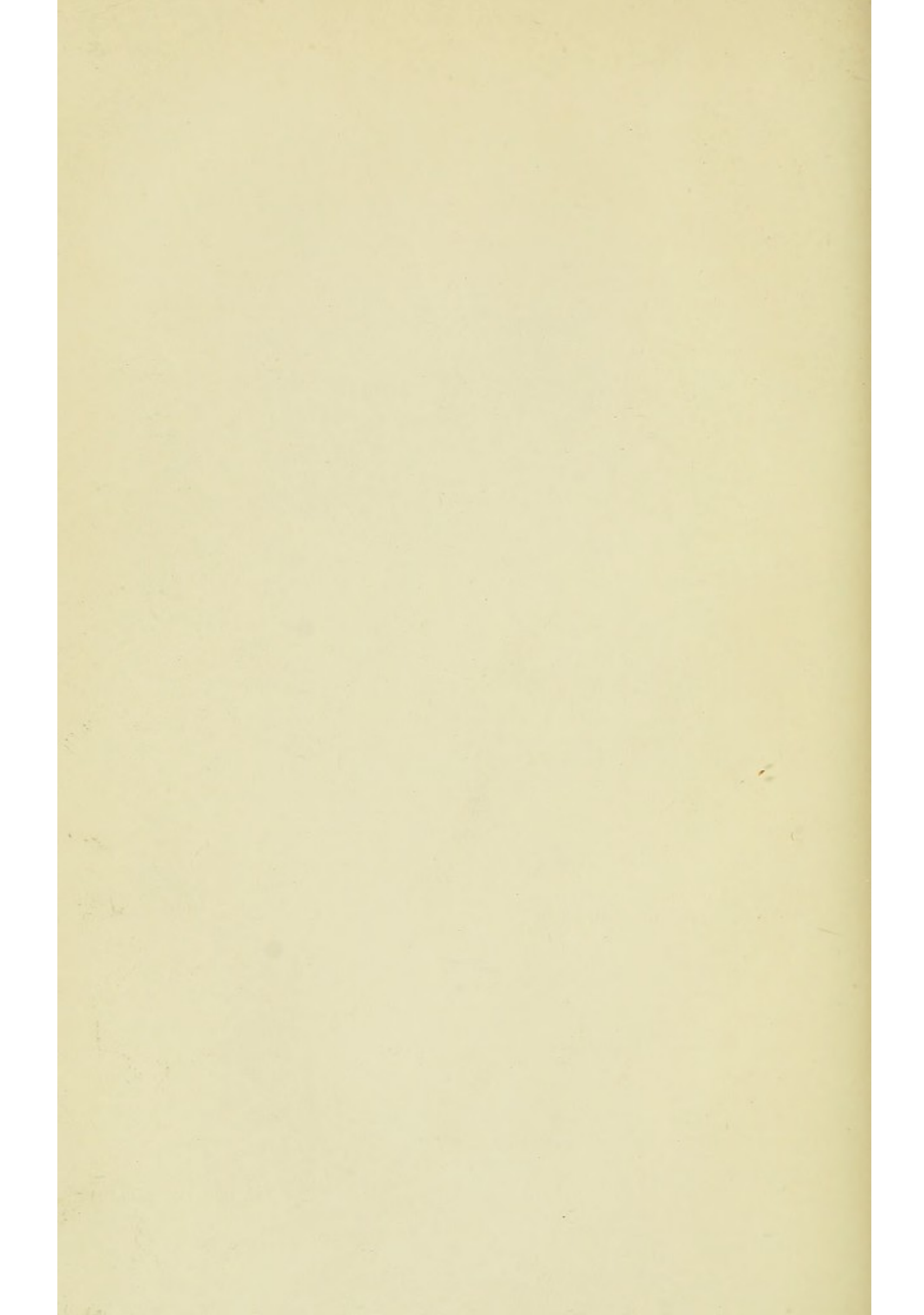


FIG. 6.

Tumour involving Gasserian ganglion (R. W. Smith's case). The growth T is seen to be mainly within the dura mater, but a prolongation extends through the foramen ovale along the inferior maxillary nerves (I.M.). O.D. The ophthalmic division.





“ In the year 1836 an emaciated and unhealthy-looking female, about 40 years of age, was admitted into the Richmond Hospital, under the care of Dr. Hutton, complaining of neuralgia of the right side of the face. She stated that the pain had commenced several months previously, had gradually increased in severity, and had now become almost unsupportable ; she had lost flesh, her sleep was broken, and her appetite had failed. Her countenance indicated extreme suffering ; the pain (which, although subject to exacerbations, never altogether ceased) was accurately limited to the right side of the face and forehead, and when indicating the situations in which it was most severe the patient marked with her finger the course of the branches of the fifth pair of nerves, and more especially the point of exit of the superior maxillary from the infra-orbital foramen. Her sufferings were so much increased by mastication that she ate but little, and speaking aggravated the pain to such a degree that she always remained silent unless when interrogated, and even upon these occasions she frequently replied by signs. She had no respite from suffering during the day, and at night sleep seldom came to her relief, nor did any of the numerous remedies employed succeed in affording even temporary ease. After having endured more severe and more uninterrupted pain than I have ever witnessed in any other instance, death terminated her protracted agonies, four months subsequent to her admission into the hospital.



“*Autopsy.*—When the cranium was opened and the brain removed, a tumour was seen in the right division of the speno-temporal fossa ; it was somewhat of the form and size of a walnut, and occupied the situation of the Gasserian ganglion ; it extended across the inner extremity of the great wing of the sphenoid bone, as far forwards as the foramen lacerum orbitale, and was covered by the superficial lamina of the dura mater, which was attenuated to a remarkable degree. The trunk of the fifth nerve appeared to enter the posterior part of the tumour, the interior of which, however, presented no trace of nervous structure ; the ophthalmic division crossed the anterior part of its superior surface ; the superior maxillary emerged from it at the foramen rotundum ; and the third division seemed to be identified with a remarkable prolongation of the tumour, which passed through the foramen ovale, the circumference of which was increased to more than double its natural extent.

“The surface of the petrous portion of the temporal bone, which supported the posterior part of the tumour, was absorbed, as well as the superior wall of the horizontal portion of the carotid canal ; between this rough and denuded portion of the bone and the deep surface of the tumour ran the Vidian nerve, which throughout its whole course, from Meckel’s ganglion to the hiatus Fallopii, was much larger than natural. The tumour was solid, and of uniform consistence ; its section exhibited



a cellular structure, without any trace whatever of nervous tissue ; nerve-fibres could, however, by the assistance of the microscope, be seen upon various parts of its surface. 'The non-ganglionic portion of the nerve was compressed, but not enlarged.'

It is obvious that, whilst this case was recorded by Dr. Smith as being an example of neuroma, modern pathologists would consider it as a sarcoma.

Caponotto, in a case of neuralgia for which he excised the Gasserian ganglion, found at the autopsy a "cholesteatoma" the size of a nut, growing from the pons varolii, at the point of exit of the roots of the fifth nerve. Lampiasi<sup>1</sup> operated by the temporal route on a case of neuralgia of the second division of the fifth nerve, and found a small sarcoma growing from the dura mater, which adhered to the bone and pressed on the nerve. He was able to remove the tumour, and improvement resulted, both as regards the neuralgia and the oculo-motor paralysis on the same side, which had been present for a short time before the operation. It is, however, most unlikely that a cure was obtained.

A detailed account is given<sup>2</sup> of a case of endothelioma (or plexiform sarcoma) with a remarkable clinical history. The patient, a man of 32, suffered

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<sup>1</sup> Lampiasi, Twelfth Congress of Italian Surgeons, 1897.

<sup>2</sup> Dercum, Keen and Spiller, in Chipault's "Chirurgie Nerveuse," vol. iii., p. 714.



for a year with severe pain in the lower limbs, violent neuralgia in the left fifth nerve, and increasing weakness and somnolence. A glandular tumour developed rapidly in the left side of the neck; on removal, it was pronounced to be an endothelioma. The facial neuralgia increased in intensity, but differed from the ordinary type in not being paroxysmal and in being accompanied by diminished sensation; all three branches of the fifth were moreover equally concerned. In November, 1899, Prof. Keen performed the Hartley-Krause operation and removed piecemeal a considerable tumour occupying the position of the Gasserian ganglion. The ganglion itself could not be made out, and the pain persisted as before. In a second operation a month later more of the tumour, which destroyed the upper edge of the petrous bone, was removed. The dura mater was opened in both operations and small granulations of the tumour were seen growing on it. The patient recovered from the operation, and this is doubtless all that can be said with regard to a cure. It is of interest to note that he had for long suffered from chronic median otitis, and it might be suggested that the primary growth was a cholesteatoma of the petrous bone. The glandular tumour in the neck was certainly secondary to the growth in the middle fossa of the skull.

Hagelstan records the autopsy of a case of endothelioma which infiltrated the left Gasserian



ganglion; Trénel, a case of "angiolithic sarcoma," which also was not operated on.

Homen and Krause observed two cases of pressure-atrophy of the ganglion, due to endothelioma and cholesteatoma respectively. Krause's patient died of meningitis two weeks after operation, owing to leaking of cerebro-spinal fluid through the wound. There is no object in separating the small series of cases into those where the Gasserian ganglion is pressed upon and those in which it is infiltrated or destroyed by the tumour, for the distinction has no practical importance. The tumour may arise in connection with the apex of the petrous bone, the pituitary fossa, the wall of the cavernous sinus, the dura mater elsewhere in this region, and possibly even from the temporo-sphenoidal lobe.

The cases given above may be classified according to their nature as follows:—

(1) Sarcoma or fibro-sarcoma of the ganglion itself—R. W. Smith's case.

(2) Sarcoma of dura mater, including endothelioma, invading the ganglion—Hagelstan's, Keen's, Trénel's, Homen's and Lampiasi's cases—five in all.

(3) Ossifying chondroma, or chondro-sarcoma growing from the petrous bone—J. Hutchinson, jun., and Kosinski.

(4) Cholesteatoma—Krause and Caponotto.

It will have been noticed in these cases of tumour pressure on the ganglion that besides the neuralgia



produced there is always some degree of anæsthesia ; further, the oculo-motor nerves are sooner or later involved, and there is frequently obstruction of the orbital circulation giving rise to proptosis, &c. In these respects there is a striking contrast to true epileptiform neuralgia.

It may be noted, in conclusion, that in some cases in which pathological changes have been described in the ganglion, severe and repeated operations have been performed previously on its main extra-cranial branches. It is conceivable that such operations may have led to ascending neuritis.



## CHAPTER IV.

### THE TREATMENT OF EPILEPTIFORM NEURALGIA.

BUT little can be said regarding the medicinal treatment. In former times free purgation was held to be useful. Belladonna had also a certain reputation, but Trousseau, after many trials, pronounced it useless. All forms of electricity have been tried, and of course lately the X-rays have been resorted to. Of the host of hypnotics and sedatives, new and old, it can be said that temporary relief may follow the use of any one of them, but that only disappointment results from their prolonged administration. Sir Victor Horsley states that he has only seen marked benefit from tincture of gelsemium pushed to poisonous doses. Opium and morphia alone will dull the pain, or even for a time remove it, but at what a cost! In some of Trousseau's patients it was pushed up to drachm doses of sulphate of morphia, or half an ounce of opium each day. In some patients such prodigious doses cause no marked bad effects, not even drowsiness; but with many it is far otherwise: the mental and physical condition both suffer; there may be induced constant torpor with head-



ache; the digestion fails, and the patient may emaciate to a marked degree.

Terrible as is the suffering caused by epileptiform neuralgia, relief obtained by increasing doses of morphia is only too dearly bought. When once epileptiform neuralgia is well established the right treatment consists in operation, and we have now to consider the exact form that this should take. Before doing so, however, a word of warning is necessary with regard to hysterical or "neurotic" patients. Strange as it may seem, it occasionally happens that epileptiform neuralgia is simulated fairly closely, though careful examination should save patient and surgeon from the mistake of resorting to operation in such cases. Operations for hysterical conditions are never advisable. Even simple incisions, made with a view of impressing the patient with a kind of hypnotic suggestion, only bring discredit on the surgeon in the long run. How, then, can a serious operation like excision of the Gasserian ganglion be justified in a case of neuralgia having an hysterical basis? That such cases may simulate true epileptiform neuralgia closely is undoubted. A good example of this was the case of a woman sent to me by Dr. R. C. B. Wall. She was a pallid and ill-nourished Jewess, aged 44, who had borne eleven children. For the last three years she had had attacks of neuralgia in the right side of the head and face, strictly limited, according to her statement, by the median



line. These attacks came on shortly before each menstrual period, recurred during the succeeding two or three weeks, and left her with a free interval only of a week or so; but the attacks were not increasing in intensity, nor were they of the explosive character of epileptiform neuralgia: on the other hand, the pain would last for some days continuously, and sometimes numbness or pain of one side of the body would accompany it. The case was evidently one in which, in an anæmic woman, neurasthenia, due to poor living and repeated pregnancies, was to blame, and one in which operation was quite out of the question. Again, any case of persistent neuralgia, in which there is a strong, neurotic, inherited tendency, is unlikely to benefit by operation.

A man, aged 30, was seen by Dr. Henry Head and myself on account of severe pain in the left side of the forehead. It was not typically epileptiform, but came on from time to time, and appeared to be situated in the frontal bone itself. His wife stated that he was strange in his manner during the attacks and she feared he would become homicidal. The patient had a dull, heavy expression, and the history was that his mother had died insane. He had never suffered from syphilis, and nothing abnormal could be found on examination of the forehead, eye, or nose. The region of the frontal sinus was, however, specially tender, and in the hope that some cause might be



found for the neuralgia, I trephined the anterior wall of the sinus and thoroughly explored it. Nothing abnormal was found, and the patient was but slightly relieved. Subsequently some operation was performed by Mr. Hunter Tod on the upper cavities of the nose, but with the same disappointing result. I saw the man two years after this, but he was neither better nor worse, and he was dissuaded from any further operation; I am convinced that his trouble was really cerebral.

Amongst the records of operation on the Gasserian ganglion are to be found several other instances of "hysterical neuralgia," and in every one the result was failure. Leaving these aside, a very important question arises with regard to the genuine epileptiform or major neuralgia. It has been already noted that of the three divisions of the fifth nerve the superior and inferior maxillary are the most severely affected, and that often the pain is for long periods confined to one only—perhaps to a single branch of them. This is especially true of the inferior dental and the infra-orbital nerves. The tendency is for the disease to spread, but when the neuralgia has for years been practically confined to one division it seems only reasonable for the surgeon to limit his interference to that division or branch only. In Trousseau's time such interference consisted, as a rule, in a simple neurotomy or nerve-stretching. In many of his cases repeated operations had been done



on a single patient. There is no more candid or masterly account of the disease than is contained in his great work:<sup>1</sup> He sums up his experience in these words: "even now, after more than thirty-six years of practice, *I have never known it to be cured in a single case radically.*" At the same time, in most cases, relief for a few weeks or months was afforded by each operation.

Prof. Billroth paid great attention to the subject, and in his time resection of the nerves, and operations on the main branches nearer the base of the skull were practised. Better results were obtained, and it is a most striking phenomenon that the neuralgia is in some cases entirely cured for a few years, but then returns in aggravated intensity and widened area. In view of such a fact, how can it possibly be true that epileptiform neuralgia is due to sclerosis or other gross change in the Gasserian ganglion or its main branches? Were that true, an extracranial operation, however extensive, could have only the most fugitive effect upon the pain, the cause of which it had not touched.

The following example is quoted as being typical. Mugnai<sup>2</sup> resected the infra-orbital nerve in a woman, aged seventy-four, for severe neuralgia, with relief lasting nearly three years; then the pain returned

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<sup>1</sup> Trousseau's "Lectures on Clinical Medicine," *New. Syd. Soc. Trans.*, 1868, vol. i., pp. 105 to 116.

<sup>2</sup> Mugnai, *Il Policlinico*, July 15, 1895.



in both second and third divisions with great intensity. It rendered the patient half-imbecile, and necessitated removal of the Gasserian ganglion. Such a case might be quoted by both the advocates and the opponents of extracranial operation. The first operation was slight, without risk of life; it obtained comfort for the patient for three years, and did not prejudice the success of the major operation. On the other hand, early resort to the latter would have saved the cruel disappointment of the recurrent pain, and the risk of the patient becoming a morphia-habitué. It is most desirable to consider the following question without bias:—

To what extent are peripheral operations justifiable in severe trigeminal neuralgia?

This question can hardly be regarded as yet decided, and three diverse opinions are held:—

(1) Neurectomy or avulsion of the affected nerve with Thiersch's forceps should always be given a trial, since relief for a period will certainly follow.

"The peripheral operations may be repeated, a little more of the nerve being removed at each time."<sup>1</sup>

"The whole series of rational operations by peripheral section should be exhausted before the final resort to intracranial operations."<sup>2</sup>

(2) Since anything more than temporary relief from peripheral neurectomy is quite exceptional,

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<sup>1</sup> J. B. Deaver's "Surgical Anatomy," vol. i, p. 564.

<sup>2</sup> Lauwers and van Geruchten.



the greater number of such operations should be given up entirely. Persistent neuralgia, when confined to one main branch of the fifth nerve, especially the inferior dental, or the infra-orbital, may fairly be treated by peripheral neurectomy.

(3) All extracranial operations on the fifth nerve should be abandoned in favour of intracranial resection of the Gasserian ganglion, its main roots or primary branches.

In support of either of these alternative views, various arguments and authorities might be adduced. One thing is, however, settled—both stretching and simple section of the peripheral branches of the fifth nerve are practically worthless, and should not be employed. It was hoped that the method of avulsion, tearing out long tracts of the peripheral branches as introduced by Thiersch, would give better results than the neater, and (to use a somewhat discredited term) more surgical method of careful excision of part of the affected nerve. It is remarkable how a nerve to its fine terminal twigs can be pulled out, as shown by many specimens figured by Krause, in his work on Neuralgia. Unfortunately, the results obtained by avulsion with Thiersch's forceps are little, if at all, superior to a well-planned neurectomy.

Dr. Deaver, who claims to have had much experience in the treatment of *tic douloureux*, argues in favour of peripheral operations, because "the period of relief following any operation is com-



paratively speaking, but temporary in the majority of cases." This argument is refuted entirely by the results of excision, partial or complete, of the Gasserian ganglion. After such operations, the period of relief is, "comparatively speaking," permanent, since the patients are totally free from recurrence, five, ten, and even more years afterwards.

Now and then peripheral operation gives a lasting cure; how rare this is may be judged from Prof. Billroth's statement, that he had never met with such a case, though he had himself operated on over thirty patients with trigeminal neuralgia. In fact, cure by this means is almost as rare as spontaneous subsidence, or cure by drugs. The patient with epileptiform neuralgia, involving more than one division of the fifth nerve, has before him these alternatives—the morphia-habit with complete mental degradation, suicide, or death from exhaustion. Peripheral operations, as a rule, offer him only temporary relief, and each recurrence is usually worse than the last. Excision of the Gasserian ganglion, is alone certain to be followed by a complete and permanent cure. These statements are illustrated by the following example:—

The patient, in the first case I operated on, was a temperate man, with nothing in his previous history to account in any way for the neuralgia. The onset of this was in 1882, when he was 42 years of age. The pain was felt along the lower jaw on the left side, and for a long time the attacks were short in comparison with the in-



tervals of freedom from the pain ; in fact, up to 1884 these intervals would amount to two to three months, but still the neuralgia was so severe that he sought treatment for it at the hospitals, and commenced to undergo a series of operative measures.

(1) The teeth were removed from the left side of the lower jaw without any benefit.

(2) He was under treatment in University College Hospital for six weeks.

(3) He went into St. Thomas's Hospital in 1884 at the end of the year, when Mr. Pitts stretched the inferior dental nerve. This was followed by marked relief for sixteen months, but in May, 1886, the pain returned as badly as ever.

(4) He was then again in St. Thomas's Hospital several times, and had the nerve repeatedly stretched, on one occasion it is said twice in forty-eight hours. The pain still continuing he went to Charing Cross Hospital, where neurectomy was done from inside the mouth.

(5) The pain only left him for a month, and subsequently spread to the region of the superior maxillary nerve, and ultimately to the back of the head ; its severity increased, the intervals became shorter, and after eight years' endurance of the suffering he sought further relief from operation.

(6) In March, 1895, Sir F. Treves removed Meckel's ganglion and the infra-orbital nerve by opening up and following the roof of the antrum of Highmore. He was then relatively free from pain for four months, but in the autumn of 1895 he was compelled to take morphine in considerable doses to get any relief. From January, 1896, to September of the next year he was a complete wreck from attacks of pain and spasm, and to a lesser extent from the narcotic and sedative drugs that were given to him.

(7) On October 1, 1897, the final operation, removal of the Gasserian ganglion, was performed. Before alluding to this operation, we must note some further details as to



the neuralgia. The spasms of pain were accompanied by convulsive movements of the depressors of the lower jaw, and of the facial muscles on the left side. These attacks of spasmodic pain ultimately came on with great regularity, the intervals being sometimes only half a minute or a minute.

Although he thought the pain was worse in damp weather, no other condition could be noticed to have any effect in producing or intensifying the pain; for instance, neither taking alcohol, nor smoking, neither exposure to the heat of a fire nor to the cold of a dry frost had any special effect. The attacks of pain came on as often when he was resting in bed as when he was up, but they completely incapacitated him from work. His memory for all recent events was very defective, and, of course, from pain and sleeplessness he was reduced to a miserably depressed condition; he was for some time of marked suicidal tendency.

The onset of each attack was most sudden; his head would be turned to the left, his mouth widely opened, and his left hand pressed to the cheek in a vain effort to get some relief from the pain. There was no true, superficial tenderness, and the only patch of anæsthesia extended from just below the V-shaped scar on the front of the cheek, made in the removal of Meckel's ganglion, down to the red margin of the upper lip. Inside the mouth the pain was felt as badly as ever along the lower jaw, in spite of the repeated operations on the inferior dental nerve, and the left lower lip and the left side of the tongue (except at the top) were involved. It is unnecessary to say that all the known sedatives had been tried, but, with the exception of morphine, none were of any material use, and the large doses of this drug required, caused delusions, and much depressed him.

A flap being turned down from the temporal fossa, with its base at the zygoma, and the temporal vessels being secured, the greater part of the squamous portion of the bone was removed by trephine and cutting forceps, without injuring the dura mater or the branches of the middle meningeal artery.



The temporo-sphenoidal lobe with the dura mater was then gradually lifted up from the middle fossa, until the foramen spinosum was reached. The only difficulty so far had been venous oozing from numerous minute vessels in dura mater and bone. An aneurism needle was passed round the middle meningeal artery, and considerable trouble was experienced in effecting the double ligature and division of this vessel, owing to the depth of the foramen spinosum from the surface (a little over two inches). The venous oozing was so troublesome that it was considered impossible to expose the ganglion on that day, and the second part of the operation was therefore deferred for a week. On the second occasion the flap of skin and muscle, which had been sewn in place, was readily detached from the dura mater, and after again raising the temporo-sphenoidal lobe with a specially-designed broad retractor, the foramina ovale and rotundum were exposed, and the superior and inferior maxillary division of the fifth nerve completely divided. Prior to this, the dura covering over the Gasserian ganglion was lifted up from it until the upper border of the ganglion and the trunk nerve were reached.

The ganglion was removed in one piece. It was thought at the time that the ophthalmic division, which is, of course, much the smallest of the three, had been divided and removed with the ganglion, but the result showed that this could not have been the case, since the patient retained sensation in the supraorbital and nasal nerves. However, the escape of the ophthalmic nerve, which was due to one's anxiety not to injure the cavernous sinus or the oculomotor nerves (an accident which has occurred in some of the recorded cases) had no bad effect upon the after-result. From the date of the operation up till now (a period of thirteen months) the patient has had no return of pain. He has got back to constant work, having been incapacitated for some years. Occasionally there is slight twitching of some of the left facial muscles, but this is painless and is hardly an inconvenience. The anæsthesia



in the distribution of the superior and inferior maxillary nerves only gives him trouble when particles of food get down between the tongue and the jaw, or the jaw and the cheek. It is of interest to note that the sense of taste as regards quinine, salt, &c., is lost on the left side of the tongue (dorsum), as also that of sensation to heat and cold and tactile impressions. It is needless to say that his left temporal, masseter, and pterygoid muscles are paralysed and have become atrophic, but he seems to be singularly little inconvenienced by this, and never complains of any difficulty in mastication. It may be noted that he had, like so many of the cases of trigeminal neuralgia, lost the teeth on the affected side long prior to the operation. The aperture in the bone forming the temporal fossa has been almost entirely closed up, so that pulsation cannot be felt and the scar has to be sought for.

The foregoing account has been largely based on Dr. Head's admirable notes of the case.

Microscopic examination of the ganglion and the nerve trunks leading from it did not reveal any marked abnormality in the ganglion cells or the nerve fibres, but there appeared to be great overgrowth of fibrous tissue throughout the ganglion; the arterioles in the latter, though imbedded in this dense fibrous tissue, presented no signs of disease of their walls.

(Note in 1904).—The patient has continued free from the slightest return of neuralgia. It is now seven years since the operation.

As the preceding case shows, when once the neuralgia has spread from one division of the nerve to another, it is useless to waste time over extra-cranial operations; but a patient with the disease confined to *e.g.*, the inferior dental nerve will hardly consent to undergo the major operation on the Gasserian ganglion, unless more limited interference



has failed. The following account deals with what seem to be the best of these operations. At the same time a number of methods, elaborate, and most of them disfiguring, which have filled such an imposing place in surgical text-books, are entirely omitted. If the majority of extracranial methods of neurectomy of the fifth nerve were forgotten, it would be to the advantage of both surgeon and patient. The extracranial operations to be described relate to (1) the inferior dental nerve, and (2) the superior maxillary division. Intracranial neurectomy of the two main divisions will also be briefly described.

### 1.—*The Inferior Dental Nerve.*

The *intra-buccal method* was introduced by Paravicini (of Italy), in 1858. The mouth is widely opened by a gag fixed on the opposite side, the cheek being held back by a retractor; the operator, with his left index finger, feels for the anterior edge of the ascending ramus, and tracing this upwards and backwards reaches the "spine of Spix." An incision of nearly an inch through mucous membrane, internal pterygoid muscle, and speno-maxillary ligament enables the inferior dental nerve to be discovered and resected. It is well to trace the nerve into the inferior dental foramen so as to make sure that the gustatory nerve (which lies near and in front of the other trunk) be not mistaken for it. Care must be taken not to



wound the inferior dental artery. The operation is performed in an awkward corner of the mouth, but the alternative method proposed by Monteveri is infinitely more difficult. He advocates an incision through the skin, which commences at the angle of the jaw and runs forward parallel to the lower border until the facial artery is reached. With knife and periosteal elevator the internal pterygoid muscle is detached inwards, and the operator ultimately reaches the spine of Spix and the inferior dental nerve. The sole advantage lies in the fact that the buccal mucous membrane is not divided. Both methods are inferior to the following:—

*Neurectomy of the Inferior Dental Nerve through a trephine aperture in the lower jaw.*

—The point of bone to be aimed at is indicated on the ascending ramus by the meeting of two lines—one perpendicular to the lower border of the jaw passing upwards from its angle, the other a continuation backwards of the alveolar margin. This point on the side of the cheek is well below the parotid duct and behind the facial vein; the skin incision of one inch should be mainly horizontal, to avoid injury to the facial nerve, but it is convenient to curve it slightly. The masseter being exposed, its fibres are partly severed, but chiefly separated, until the bone is reached and bared with a periosteal elevator. The pin of a small (half-inch) trephine is then inserted exactly



at the spot above-mentioned, and when the outer table of compact bone is traversed, the disc is removed by means of the elevator. It is almost certain that the groove containing the inferior dental nerve and vessels will be opened thereby, and it should very carefully be cleared on either side with a small chisel or bone-cutting forceps. The groove should be followed upwards and downwards, with due caution not to injure the inferior dental artery, until the nerve can be raised along on a hook. With Thiersch's forceps a long piece of both ends of the divided nerve can sometimes be drawn out; if not, as much should be cut away as possible. The bone disc need not be replaced, and two or three fine sutures will suffice for the wound, which heals rapidly. The patient should be kept on liquid or soft food for a few days.

The success of the operation depends chiefly on following the landmark given exactly, and avoiding injury to the companion artery. As a rule, the dental nerve lies just in front of the latter, and is readily distinguished, once the canal is opened, by its whiter colour.

After this neurectomy the pain is, as a rule, entirely absent for one, two, or more years, but it is exceptional for no recurrence of any kind to be experienced. It may be noted that immediately after the operation, for a few days, the patient will complain of aching, due to the traction of the proximal end. The method and the amount



of relief that is to be expected from it is illustrated by the following case:—

Samuel G., a florid, healthy-looking man, before the onset of neuralgia had been a free liver and suffered from slight symptoms of gout. He had Dupuytren's contraction of the ring finger in each hand. His father and one brother were said to have died from gout. At the age of 59 the right, inferior, dental nerve became the site of severe neuralgia, for which all the teeth were removed from the lower jaw behind the incisors on the right side. No relief was obtained. A year later Mr. Stanley Boyd performed an operation on the inferior, maxillary division just below the foramen ovale. The pain was relieved for about twelve months, but it returned with increasing frequency of the attacks until it was almost continuous both night and day. The pain was especially severe over the right mental foramen, causing reflex spasm of the facial and masticatory muscles. He obtained some relief by violently pinching the skin over the lower jaw, this becoming a constant habit.

As the neuralgia was confined to the inferior dental nerve it did not seem to justify operation on the Gasserian ganglion, and on September 7, 1899, I resected the inferior, dental nerve, after trephining through the outer part of the ascending ramus of the lower jaw. The nerve was exposed without difficulty, and about one inch of it was removed; the



nerve was quite normal. For a week after the operation the pain continued as bad as before, but it gradually left him and he was free for eighteen months, when it returned with increasing intensity, involving the right cheek and both jaws; the neuralgia was occasionally referred to the eye. Medicines failed entirely to relieve him, and the patient got into a miserable condition, almost unable to sleep, or to take food without bringing on spasms of pain. On more than one occasion he threatened suicide.

On October 8, 1901, the right Gasserian ganglion was operated on by the temporal route. The patient had emphysema and pulmonary congestion at the bases, and was therefore a bad subject for an anæsthetic. A.C.E. was carefully administered, with the patient sitting in a dental chair, but owing to respiratory trouble it was found necessary once or twice to lower him to the horizontal position. I removed a circular area of bone about three inches in diameter with the trephine and cutting forceps, and succeeded in exposing the ganglion without dividing the middle meningeal artery; the lower half of the ganglion, or rather more, with the superior maxillary division, was completely removed. Venous hæmorrhage caused some trouble. No bone was replaced, the drainage tube being removed on the second day; the wound healed perfectly, and the patient left the hospital three weeks after the



operation. For over two years he has continued in excellent health being now 66 years old, and there has not been the slightest return of pain. He takes too much stimulant—a bottle of champagne a day—but considers himself entitled to it, after what he had gone through. The area of anæsthesia, as shown in fig. 20, includes the whole of the cheek, the temporal region and both lips to the middle line, as well as the ala of the nose. He masticates very well, in spite of the atrophy of the masseter, pterygoids, and temporal muscles on the side operated on.

NOTE.—Early in 1904, that is, nearly three years after the operation, the patient died. His son stated that, so far as the neuralgia was concerned, he had remained quite free from any return.

Dr. Ewing Mears performed a somewhat similar operation in 1883, only he trephined the outer table of the jaw about the mental foramen, and then drew out some three inches of the nerve. His case was free from recurrence at the end of nine months, though it is probable that the neuralgia returned later.

The operation on the inferior dental nerve just described is easy to perform ; it leaves no deformity, and is worth doing in any case of persistent neuralgia starting in the lower jaw. The patient should, however, be told that whilst there is a chance of permanent recovery, the relief is more



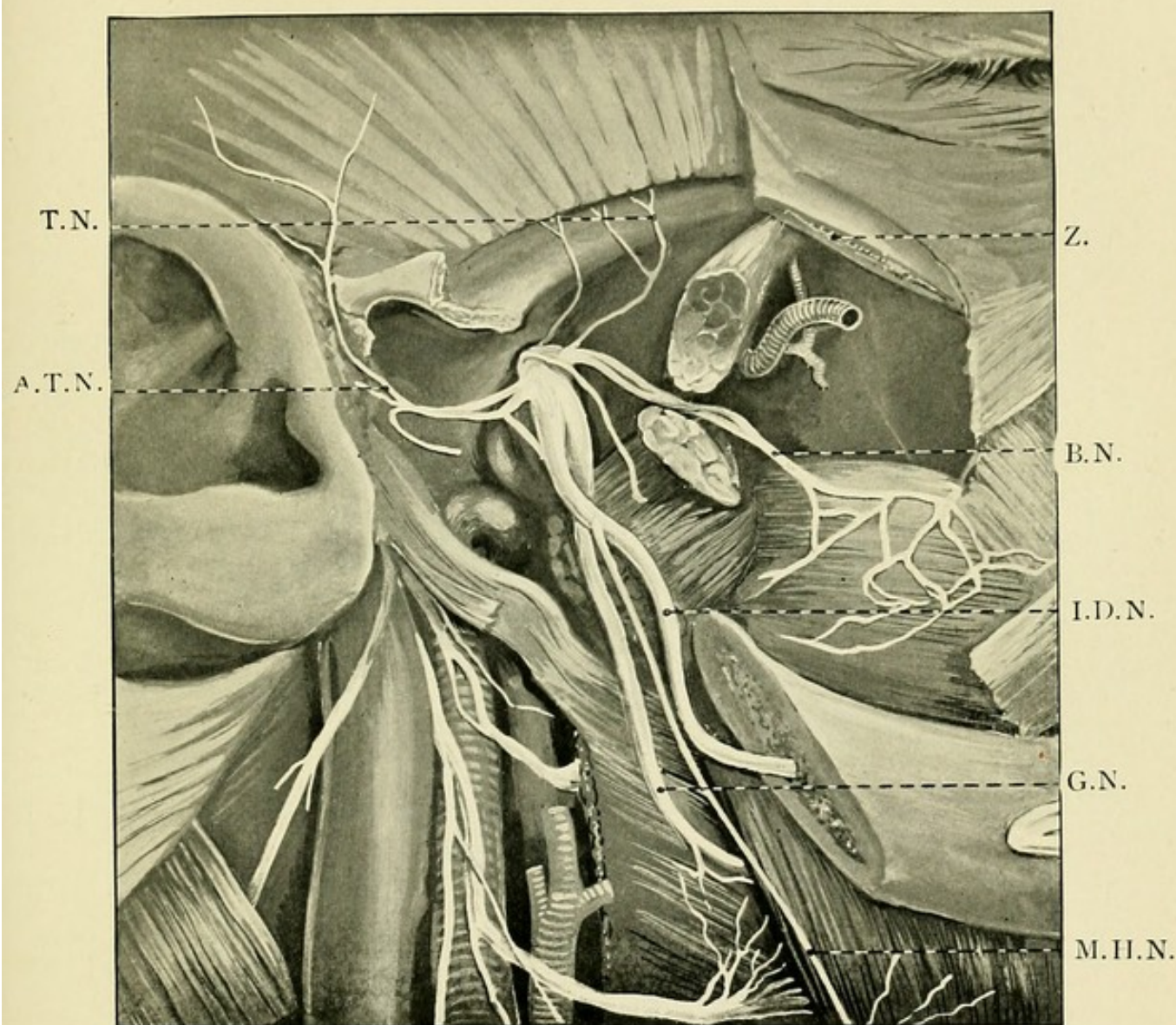


FIG. 7.

The main branches of the inferior maxillary division, from a dissection in the London Hospital Museum. Z.—The zygoma, cut at each end and removed. T.N.—Motor branches to the temporal muscle. A.T.N.—Auriculo-temporal nerve. B.N.—Buccal nerve, joining in a plexus with branches of the facial nerve to the buccinator muscle. I.D.N.—Inferior dental nerve. G.N.—Gustatory or lingual nerve. M.H.N.—Its mylohyoid branch.







likely to be for a year or two only, and that in the case of recurrence a more radical operation can be done on the Gasserian ganglion.

This is the only peripheral operation on the third division of the fifth nerve that can be really recommended. Neurectomy of the gustatory nerve is hardly worth discussing; it has occasionally been practised for the pain of cancer of the tongue, but the procedure has fallen into disuse. As to the formidable methods of approaching the third division just below the base of the skull, surgery will gain by their complete abandonment. They almost all involve division of zygoma and coronoid process, and owing to hæmorrhage and the deep awkward wound, the operations are extremely prolonged and difficult. The results are very poor, since movements of the jaw are usually limited, an ugly scar being left on the face, and the neuralgia quickly returns. If operation is indicated upon the third division alone, the intracranial method should certainly be preferred. Some may think this condemnation of the many elaborate methods alluded to somewhat sweeping, but experience will probably show that it is right.

## II.—*The Superior Maxillary Nerve.*

In order to avoid the disfiguring division of bone required by the ordinary methods of excising the superior maxillary nerve in the pterygo-maxillary fossa, M. Poirier<sup>1</sup> brought forward a new method.

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<sup>1</sup> Poirier, *Bull. et mém de la soc. du chir.*, t. xxv., p. 414.



It consists briefly in two steps:—(1) the infra-orbital nerve is exposed on the front of the face just below the foramen, is divided, and a silk ligature put round its proximal end. (2) A vertical incision, one centimetre behind the junction of the malar bone with the orbital margin, is made, and steadily deepened through the temporal muscle. Down in the hollow, the superior maxillary trunk is exposed (!) and seized with forceps. Traction is made so as to draw the whole nerve out from the upper jaw bone, as far forwards as the ligature.

There are two strong objections to the method: (1) the depth of the incision and the bleeding render it almost impossible to make sure of the nerve; and (2) even if it be secured in the forceps, it may be impossible to draw the peripheral part outwards.

Carnochan's method of reaching the pterygo-maxillary fossa from the front by trephining both walls of the antrum of Highmore, and following back the infra-orbital nerve in its roof is well-known. Many examples have been recorded by Mr. Chavasse<sup>1</sup> and Sir Frederic Treves.<sup>2</sup> It is a difficult operation, and the neuralgia almost always returns after an interval varying from a few months to a year or two.

The following account is taken from the second

<sup>1</sup> Chavasse, *Medico-Chirurgical Soc. Transactions*, 1884.

<sup>2</sup> Sir F. Treves, "Operative Surgery," 1904, vol. i., p. 209.



edition of the Operative Surgery, revised by Sir F. Treves and myself.

“A V-shaped incision is made on the front of the cheek, so placed that the apex points directly downwards, and the centre of the V is opposite to the infra-orbital foramen. The incision should form two sides of an equilateral triangle, each limb of which measures a little more than one inch.

“The knife is carried at once down to the bone, and the triangular flap formed by the soft parts is turned up over the lower lid. A long silk suture is introduced into the apex of the flap, in order that it may be drawn well upwards out of the surgeon's way.

“The infra-orbital nerve is sought for and isolated as it is emerging from the foramen. The bone having been cleared, a portion of the anterior wall of the antrum measuring from half to three-quarters of an inch square is removed with a chisel and mallet. The infraorbital foramen will be a little above the centre of the part removed. The mucous lining of the antrum having been divided, that cavity is fully opened. In order that the rest of the operation may be conveniently performed, a small electric lamp is needed, which may be fixed to the surgeon's forehead. In no operation is a good light more essential.

“The posterior wall of the antrum is now exposed, and a portion about a quarter of an inch square is cut away with a fine chisel and mallet.



“ In removing the two portions of bone some surgeons use trephines—a half-inch trephine for the anterior wall and a quarter-inch for the posterior. The chisel is, however, by far the more convenient and precise instrument, and inflicts a less degree of injury upon the surrounding tissues.

“ The hæmorrhage is very free, and some little time may now be devoted to arresting it as far as is possible.

“ The next step consists in dividing the mucous lining on the roof of the antrum, under the course of the infra-orbital canal. The bone forming the floor of this canal must be broken away from one end of the maxilla to the other. This is best effected by means of scissors, aided by a fine, carpenter's bradawl and a slender, bone elevator or stout director. The bone is thin and offers little resistance, and the nerve, which must be most carefully preserved and carefully followed line by line, forms the guide to the surgeon's movements. Much bleeding may be expected from the damaged infra-orbital vessels, which can seldom be surely isolated. When the posterior wall of the maxilla is reached, the white and conspicuous nerve will be hanging loose in the cavity of the antrum. Slender dissecting forceps with long blades are needed during this stage, and become still more necessary when the region of the foramen rotundum is reached.

“ The bone of the hinder wall of the antrum must



be so completely removed that the nerve is seen to hang free in the cavity produced. The wound may now be stuffed for a while with a conical piece of sponge, in order that the hæmorrhage, which is still free, might be held a little in check.

“By means of the long, slender forceps and a director, the surgeon endeavours to make out the position of the trunk as it issues from the foramen rotundum, and, if possible, the precise locality of the ganglion. In this attempt he is aided by the infra-orbital nerve, upon which traction (by means of a silk thread), is maintained. Finally, the superior maxillary nerve is divided close to the foramen rotundum by a pair of very slender, curved scissors, and any branches which still hold the nerve in position having been divided, the whole trunk is removed with the ganglion attached.

“At this step of the operation also much bleeding may be expected. The nerve cord removed should measure not less than one-inch and three-quarters.

“The antrum having been sponged out, the skin incision is united by sutures and the selected dressing applied. A small drainage tube should be maintained in the lower angle of the wound for the first twenty-four hours.”

If an extracranial operation is to be performed on the superior maxillary division, probably the best method is one which is attributed to an American surgeon named Storrs. It is described by Dr. Cook in the “Annals of Surgery,” 1903, vol. xxxvii.,



p. 854. It has the merit of leaving only an inconspicuous scar on the face. The following description is in Dr. Cook's own words :

“Place the patient half reclining in a chair, wedged with sand-bags. The operator seats himself on a stool facing the patient, on the side of the eye on which he intends to operate. One assistant is necessary to give the anæsthetic, and a second to hold the retractor. The lower edge of the orbit can be easily felt through the skin. Make a clean incision along this edge, from the inner to the outer angle of the orbit, through the tissues, including the periosteum, down to the bone. Then with a blunt instrument carefully elevate the periosteum from the floor of the orbit, going well back and exposing the speno-maxillary fissure. Lift the eyeball out of the way with a spoon-shaped retractor inserted under the periosteum. Usually a bluish spot will appear, showing the situation of the infra-orbital nerve, covered by a thin plate of bone, in its canal in the floor of the orbit. Should, however, there be any difficulty in locating the nerve, it can easily be done by passing a probe into the infra-orbital foramen and up into the orbit. Having located the nerve, with a chisel or any suitable instrument remove the thin plate of bone covering it. The nerve can then be easily hooked up and brought to view. The infra-orbital artery is usually torn at this time and bleeds for a few moments, but it is of no importance, and will soon take care of itself.



“ Having hooked up the nerve, ligate it securely with a piece of silk passed around it with an aneurism needle. Then cut the nerve, leaving the ligature fastened to the proximal end of the cut nerve. We now have the nerve under perfect control. By making a slight traction on the ligature we can bring the nerve into view, and by following it on can readily crush down the thin wall of the canal, removing the bone fragments with suitable forceps. When the nerve enters the spheno-maxillary fissure it passes out of the bony canal and is only surrounded by soft structures, which can easily be hooked or wiped away. Should the spheno-maxillary fissure be narrow and not readily admit the introduction of instruments, it can easily be widened by inserting a suitable, blunt instrument and by wedging or widening the walls. It is remembered that the upper wall of this fissure is the strong wing of the sphenoid bone, and that the lower angle is the thin wall of the antrum. If either bone should break in these manipulations it would be the wall of the antrum which would be crushed down and out of the way and would cause no trouble. Having the nerve thus free to the foramen rotundum, next slip the ends of the silk ligature through a loop of wire held with a small snare (the Jarvis snare of the rhinologists). The loop of wire in the snare is passed down the nerve to the foramen rotundum, just as a tunnel sound is passed over a filiform



bougie. When the loop of wire reaches the foramen rotundum it is closed, and the nerve is cut and removed.

“To return now to the distal end of the nerve. Separate the integument from the bone down to the infra-orbital foramen, gather up with a hook the mesh of nerves going to the cheek and drag the divided nerve through the foramen. Storrs then put the nerve into the loop of a threaded needle and carried it down into the mouth, leaving the end which had been in the infra-orbital canal suspended between the alveolus and the upper lid; this end he cut off even with the mucous membrane. This was for the purpose of preventing any possible restoration of any communication between the peripheral branches of the nerve and the stump left at the foramen rotundum. To complete the operation, place a small gutta-percha-tissue drain in the track of the nerve, extending from near the foramen rotundum to the surface; suture the skin wound. The drain should be removed at the end of twenty-four hours.”

It is stated that Dr. Storrs operated by his method on some ten or twelve patients, and that of these at least two remained free from neuralgia for over ten years. This is an unusually favourable result from any form of peripheral operation. At the same time it must be uncertain whether the central end of the nerve is divided beyond its branches to the palate and molar teeth.



Further experience must prove whether the intracranial excision of the superior maxillary division (see page 71) or Storrs' operation is the better. The former is, perhaps, the more severe, and certainly the more radical of the two. I think Carnochan's method will be entirely abandoned, and Poirier's is not practical. It would be both tedious and unprofitable to quote descriptions of the many ingenious variations of the operation, to which different surgeons' names have been attached. They are at least a dozen in number, and most of them involve an extensive osteoplastic operation on the outer orbital wall, the zygoma, or the upper jaw.

"Mugnai's operation" may be briefly mentioned from amongst these. A nearly rectangular incision is made along the upper border of the zygoma, forwards to the outer orbital edge, and then downwards towards the last molar tooth over the anterior edge of the malar bone. The orbital contents are pushed upwards and inwards until the spheno-maxillary fissure is reached; with a wire saw the malar bone is sawn through in two directions, back into the temporal fossa and downwards at its junction with the superior maxilla. The zygoma is chiselled through and the malar bone turned downwards. The subsequent steps, following back the infra-orbital nerve towards the foramen rotundum, &c., need not be described.

This method, like so many others, involves a scar



on the face, and what is more important, an elaborate division of bone, which may not unite again well, and may even necrose. It hardly gives any better access to the superior maxillary nerve than Storrs' simple incision at the lower edge of the orbit; and as regards the clean excision of the nerve trunk does not compare with the intracranial method described. The term "Storrs' method" has been used with reserve, priority of description or invention in these matters being most uncertain. Professor Billroth was in the habit of employing a similar incision along the floor of the orbit, and mentions at least one case in which he tracked the superior maxillary division "back to the foramen rotundum."

It will be convenient to summarise the various forms of operation, and to indicate which are the best to follow:—

(1) Intracranial resection by trephining the wall of the temporal fossa (see page 71). By this method alone the nerve is excised before it has given off any branches; it is certainly the most radical and promising.

(2) The infra-orbital method:—following this nerve back along the floor of the orbit to the pterygo-maxillary fossa. Very little bone is divided, and the scar is not conspicuous.

(3) Trephining the antrum of Highmore to reach the pterygo-maxillary fossa (Carnochan's method). This should be given up.



(4) Resection of the outer wall of the orbit (Mugnai's method). This has no advantages and several drawbacks.

(5) The trans-zygomatic operations, by which the fossa is reached from the outer side. On no grounds can these be recommended.

It will be seen that the choice of the surgeon lies between the first and second of the above methods, and I believe the first to be the better.

### III. *Intracranial Resection of the Main Division of the Fifth Nerve.*

Two main considerations naturally suggest themselves in cases of very severe and persistent neuralgia, which is confined to the distribution of one of the three main divisions of the fifth nerve.

(1) It is logical to confine operative interference to the division which is alone implicated.

(2) The nearer to the Gasserian ganglion that the resection can be performed the less will be the risk of recurrence.

It is further important to note that, even when slighter radiations of pain have accompanied intense neuralgia of one division, operation on the latter alone will secure cessation of the pain in the other. This rule is probably not absolute, but Prof. Chiene of Edinburgh tells me that he has noticed this result in several cases. All three divisions of the fifth nerve can be completely isolated only



inside the skull. The superior maxillary trunk in whose distribution persistent neuralgia is fairly common, has an intracranial course of about half an inch. This portion can be completely isolated and removed, so that there is no possibility of new nerves growing between the ganglion and the peripheral branches.

In one case of my own, given in detail (on page 70), the intracranial resection of this nerve was perfectly successful. The two earliest operations of Prof. Krause for fifth nerve neuralgia concerned the superior maxillary trunk alone. Subsequently he performed the major operation (removal of the entire ganglion), and holds that this, with division of the root of the ganglion, "alone protects the patient from recurrence." This is too absolute a statement. I think, from Prof. Krause's account, that it is certain in some of his cases, the ophthalmic division with its root fibres escaped. Certainly, in many cases in which these have been deliberately spared, no recurrence of the neuralgia has taken place after intervals of three to five years, as in the case of several of my own patients.

Dr. J. Crawford Renton,<sup>1</sup> in two cases, deliberately avoided interfering with the ophthalmic division, and in both the neuralgia was entirely cured. G. R. Fowler,<sup>2</sup> in a case in which the neuralgia

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<sup>1</sup> *British Medical Journal*, November, 1900.

<sup>2</sup> Fowler, *New York Medical Record*, 1894, p. 745.



was confined to the second and third divisions, commenced an operation by the temporal route, intending to excise the whole Gasserian ganglion. He had previously ligatured the external carotid artery, and the hæmorrhage was but slight ; nevertheless, he found it impossible to remove the ganglion, owing to its close adhesion to the dura mater. He divided completely and removed parts of the superior and inferior maxillary divisions. The patient, who had been previously addicted to large doses of morphia, entirely left off the drug. At the end of two years, when he was last seen, no recurrence of pain had taken place, and there was complete anæsthesia in the area supplied by the two divided nerves.

In seven cases of my own, in which the excision was deliberately limited to the lower part of the ganglion with the two lower divisions, the patients have been entirely free from recurrence of pain. They have been followed up for periods, ranging from two to seven years.

(1) So far as I can ascertain the *ophthalmic trunk* alone has never yet been the subject of intracranial excision.

(2) The *second or superior maxillary division* is the most suitable for intracranial resection, as nearly half an inch of it is available before it passes through the foramen rotundum.

The method of operating will be understood by reference to fig. 8, and from the description of the following case :—



A ship's officer, aged nearly 60, but of fine constitution, had suffered for several years from intense pain in the right cheek and upper jaw. The neuralgia was typically epileptiform, the attacks becoming more and more frequent during the last four years. He had had a number of teeth removed without the slightest relief, and medicines were equally unavailing. He struggled on with his duties on board a Cape liner, and about Christmas, 1902, he consulted Sir Frederick Treves with regard to operative measures, who kindly sent him to me with a note suggesting removal of Meckel's ganglion and the infra-orbital nerve. The distribution of the neuralgia was always the same, and the parts were very tender, though during an attack some relief was obtained by the patient violently grasping the tissues of the cheek. The lower eyelid, both sides of the cheek, the palate and the gums on the right side formed the area involved. Lachrymation and congestion of the right eye were frequent.

It might be suggested that exposure on deck to wind and wet was a predisposing cause of the neuralgia, but the attacks were equally severe when he was on land, and they occurred both by day and night. He had the aspect of great suffering and depression.

My friend Mr. T. Crisp English assisted me at the operation, which was performed with the patient fixed in a dentist's chair, in order to lessen







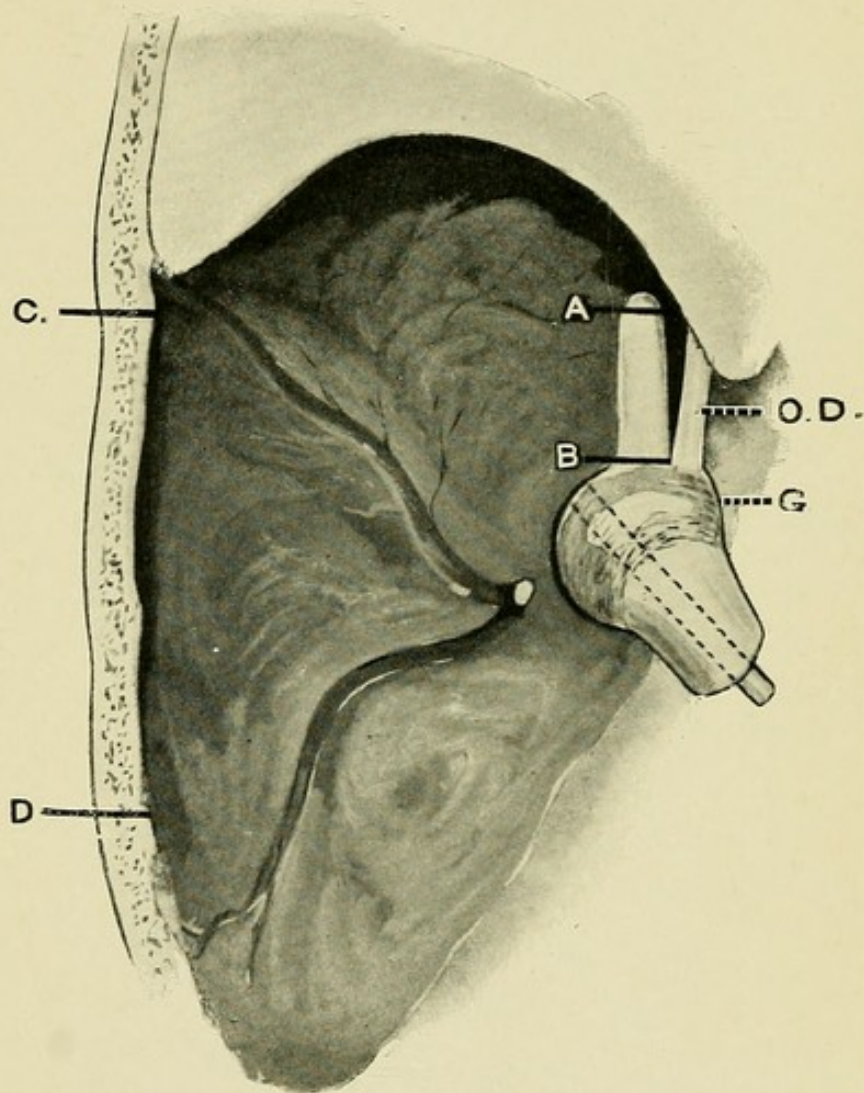


FIG. 8.

Intracranial resection of the superior maxillary nerve. A.B.—Portion of the nerve to be excised. C.D.—Wall of temporal fossa cut away in the operation. O.D.—Ophthalmic division. G.—Gasserian ganglion.



the trouble from venous hæmorrhage. A horse-shoe flap was turned down from the temporal region, having its base at the zygoma, the flap including part of the temporal muscle and the pericranium. With a large trephine and cutting forceps the subjacent bone was removed, and the dura mater exposed. As in the operation for removal of the Gasserian ganglion, the dura mater and temporo-sphenoidal lobe were then carefully pushed upwards and inwards, making for the foramen rotundum as the first landmark. In this respect the two operations differ, as in dealing with the Gasserian ganglion the foramina spinosum and ovale are first sought for. Considerable difficulty was met with owing to the thin and fragile character of the dura mater, and some cerebro-spinal fluid escaped. Ultimately, the trunk of the superior maxillary division and part of the Gasserian ganglion were thoroughly exposed, a broad spatula of soft metal being used to retract the dura mater and brain. The whole of the nerve was then removed, a small drain being subsequently inserted, and the flap sutured in position. None of the bone removed was replaced. Primary healing followed, and no complication of any sort occurred.

The patient returned a month later to his duties, and has made regular voyages to and from the Cape ever since. I have waited eighteen months before reporting the case in order to ascertain



that the relief is permanent, and am glad to state that he has not had the slightest recurrence. The anæsthesia is most marked over the right cheek and superior maxillary bone, and it also involves the soft palate and lower eyelid. He can eat and talk with perfect comfort, whereas before the operation both acts brought on spasmodic pain. The scar is hardly to be noticed, the gap in the bone has practically filled up, and there is, of course, no paralysis of masticatory muscles on that side, such as follows removal of the Gasserian ganglion. I am confident that no recurrence is likely to take place.

It would be erroneous to suppose that the operation is an easy one: the depth of the nerve trunk (three centimètres or more from the wall of the temporal fossa) and the troublesome oozing in a narrow space, where it is essential to see and define a nerve-trunk of small size, prevent this. But having had the opportunity of assisting my colleague, Sir Frederick Treves, in several operations on Meckel's ganglion I can safely assert that the intracranial route is at least as easy as the facial one, and I believe it affords the more certain access.

Mr. Stanley Boyd performed a similar operation about the same time as myself. In his case the result was perfectly satisfactory for a year, but at the end of that time a slight recurrence of neuralgia was reported, though its exact localisation was doubtful.



(3) Of intra-cranial resection of the *third or inferior maxillary division* I have had no personal experience. The Gasserian ganglion reaches almost to the foramen ovale, immediately beneath which the trunk breaks up into a number of branches ; hence, intra-cranial resection will include the adjacent part of the ganglion itself, a fact illustrated by the following two cases :—

Codivilla, an Italian surgeon, in 1897, operated on a woman aged 53, who had suffered for four years from severe neuralgia in the distribution of the inferior, maxillary nerve alone. By the temporal route he exposed the foramen ovale, divided the nerve completely across, and removed it with the adjacent portion of the Gasserian ganglion. The neuralgia entirely ceased, the case being reported in 1898, one year later ; there was of course atrophy of the masticatory muscles on that side, with anæsthesia of the lower lip and part of the cheek, and the mucous membrane over the jaw. In another case, a man, aged 43, who had already undergone an intracranial operation on the second division, Codivilla carried out the same proceeding as mentioned above, on the third division and the adjacent part of the Gasserian ganglion. The operation had to be done in two stages (with three days' interval between them), owing to hæmorrhage from the middle meningeal artery.

*Conclusions.*—From the foregoing account, it will be understood that, in the treatment of epileptiform



neuralgia, a certain proportion of cases may fairly be subjected to less radical measures than removal of the Gasserian ganglion. In these cases the neuralgia is practically confined to one main division of the fifth nerve or even to a single branch. Supra-orbital neuralgia has not been specially discussed, but now and then a case may arise in which resection of this nerve is justified. The operation is so simple that it does not need description.

*If the neuralgia be limited to the infra-orbital branches, resection of the nerve by following back the canal in the orbital floor may be tried. If the neuralgia concern also the palatine branches, intracranial resection of the superior maxillary trunk should be carried out. If the inferior dental nerve be alone affected, it should be resected through a trephine aperture in the outer table of the lower jaw. When the neuralgia concerns several branches of the inferior maxillary division (e.g., the inferior dental and the auriculo-temporal), intracranial resection of the trunk and adjacent part of the Gasserian ganglion is indicated.*

*For all other cases, those in which the neuralgia has already invaded two of the main divisions of the fifth nerve, the major operation on the ganglion (see Chapter V.) should be carried out as affording the only hope of permanent cure.*

If these rules be followed the subject is rendered simple, a host of elaborate operations may be discarded, and the disappointing results which have followed them in the past may be avoided.



## CHAPTER V.

### OPERATIONS ON THE GASSERIAN GANGLION.

THE surgeon who first suggested in print the operation of removal of the Gasserian ganglion was Dr. Ewing Mears of Philadelphia. In the *Transactions of the American Surgical Association* for 1884, he reported a case of neurectomy of the inferior dental nerve, and at the end of the paper wrote: "If in any case I believed . . . that the morbid condition had invaded the Gasserian ganglion, I would not hesitate to enlarge anteriorly the oval foramen, . . . and by traction draw down the ganglion . . . and proceed in a cautious manner to break it up or remove it by section with small blunt-pointed scissors."

It is plain that the operation proposed, which Dr. Mears had no opportunity of carrying out himself, was identical with Professor Wm. Rose's pterygoid method which was first carried out in April, 1890, the case being published in the *Lancet*, November 1, 1890. This was the pioneer operation, and was followed next year, 1891, by Sir Victor Horsley's case of division of the roots



above the ganglion. This latter case proved fatal from shock, and it is only during the last year, 1903-1904, that this dangerous method has been revived by other surgeons.

In 1892 Dr. Frank Hartley,<sup>1</sup> of New York, and Professor Krause,<sup>2</sup> of Altona, independently devised the temporal method of reaching the ganglion, and it is only from this date, *i.e.*, twelve years ago, that one can seriously estimate the value of the intracranial operation for trigeminal neuralgia. In 1903, Professor Krause was able to report that he had followed one of his earliest cases for nine and a half years, and that no recurrence had taken place. I have followed up two of my own cases with the same satisfactory result for seven, and seven and a half years respectively. Krause claims for his "first effective extirpation of the ganglion performed on January 31, 1893, that it was, undoubtedly, the first operation of the kind."

Professor Krause, in 1901, stated that he was convinced, after trial of the various modifications, his original method gave the best exposure of the ganglion. With this conclusion I am heartily in accord. The temporal route alone affords free access, and whilst it is necessary to remove the bony floor of the fossa as far inwards as the infra-

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<sup>1</sup> Hartley, *New York Med. Journal*, vol. lv., 1892, No. 12.

<sup>2</sup> Krause, *Deutsche Med. Woch.*, 1893, No. 15, and a separate work, *Die Neuralgie des Trigeminus*, Leipzig, 1896.



temporal crest, there is no need to go further, as some surgeons recommend.

"After ligature and section of the middle meningeal artery, the second and third divisions of the fifth nerve are fully exposed by lifting up the detached dura mater, the third division is grasped and stretched by narrow curved forceps, whilst the dura is pushed gently off the ganglion itself until its roots are exposed; during this stage the cerebro-spinal cavity is usually opened and the fluid escapes. The ganglion is then seized with Thiersch's forceps and drawn out, after section with a tenotome of the roots and the second and third divisions." Nothing is said as to section of the ophthalmic or first division, but this should be cut rather than torn through.

Such is an outline of Professor Krause's method, which is almost identical with Hartley's operation, and it has served as a model for the many surgeons who have followed them, many of whom have introduced more or less important modifications. I will describe in detail the method now recommended, with the understanding that the operation given is that suitable for those cases in which the ophthalmic division is but little involved in the neuralgia, *i.e.*, the great majority which come under surgical treatment.

(1) *Preparation of the Patient.*—The whole head should be shaved and cleansed thoroughly, the scalp being treated with ether and 1 in 20 solution of



carbolic acid in alcohol. It is important for the patient to avoid long fasting before the operation, and a cup of good beef-tea may be taken three hours beforehand. The best anæsthetic is probably the A.C.E. mixture, or one of chloroform and ether without the alcohol.

(2) *The Instruments, &c., required.*—A dentist's chair with suitable head-rest is strongly advised,

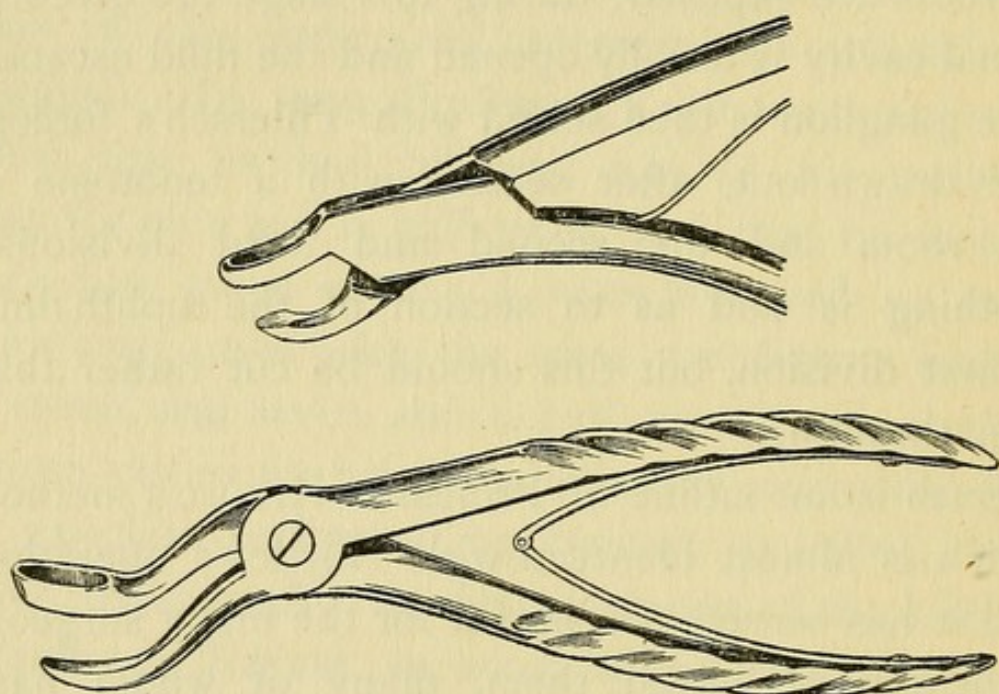


FIG. 9.—Two forms of Hoffmann's Rongeur or cutting forceps for enlarging the aperture in the cranium. (Half-size.)

though some surgeons use the ordinary operating-table. In this case, the shoulders and head should be raised as much as possible.

A good-sized trephine is required with a diameter of  $1\frac{1}{4}$  inches; electric head-lamp; a broad and blunt-ended dissector (fig. 10); Hoffmann's bone-cutting forceps for enlarging the trephine hole (fig. 9); a flexible, broad, metal retractor for lift-



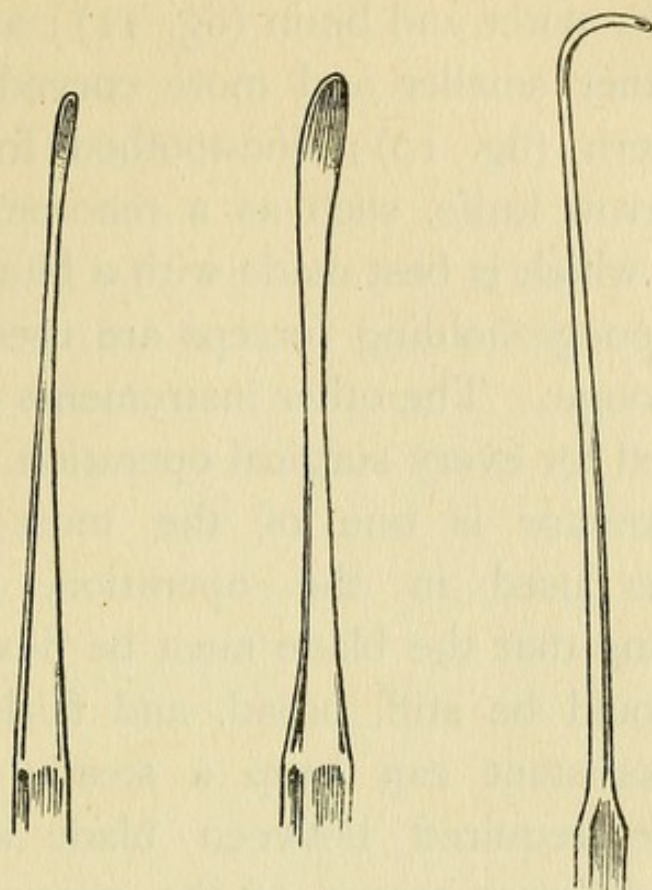


FIG 10.—Aneurism needle with fine end, and two elevators for detaching the dura mater from the skull. (Full size.)

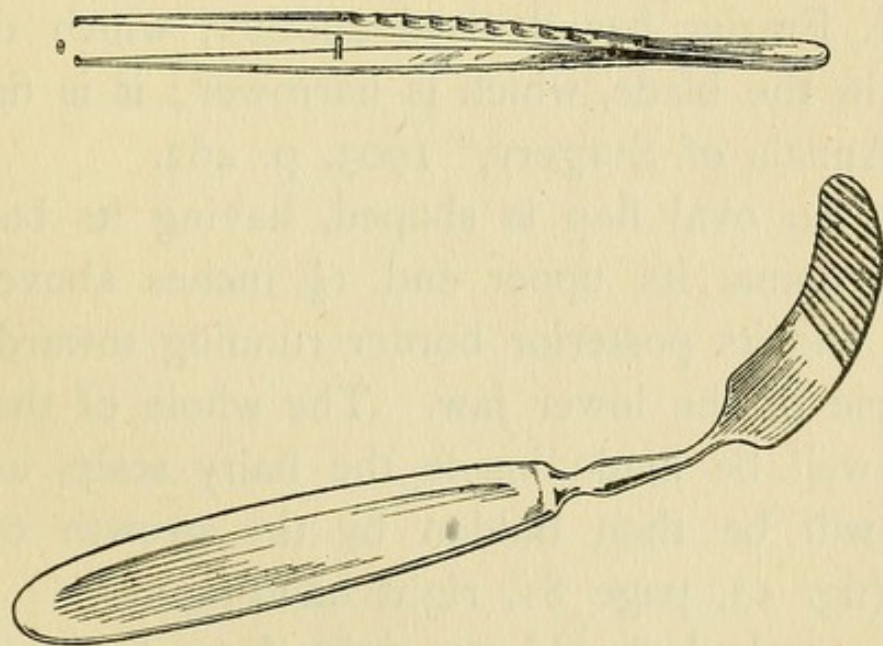


FIG. 11.—Fine-toothed forceps and flexible metal retractor (Krause's form). (Both half natural size.)



ing the dura mater and brain (fig. 11); an aneurism needle, rather smaller and more curved than the usual pattern (fig. 10); fine-toothed forceps (fig. 10); a narrow knife, such as a tenotome or cataract knife, which is best made with a blunt end.

Small sponge-holding forceps are used with soft Turkey sponge. The other instruments are such as are required for every surgical operation.

The retractor is one of the most important instruments used in the operation, its special feature being that the blade must be flexible. The handle should be stiff, broad, and fairly short, so that the assistant can keep a steady grip of it. The angle required between blade and handle varies at different stages of the operation, and a stiff blade will be liable to cause injurious pressure on the brain; hence, flexibility is essential. Krause's special retractor is figured on p. 79. Dr. C. H. Frazier has devised another, which differs only in the blade, which is narrower; it is figured in "Annals of Surgery," 1903, p. 462.

(3) An oval flap is shaped, having its base at the zygoma, its upper end  $1\frac{1}{2}$  inches above this level, and its posterior border running towards the condyle of the lower jaw. The whole of the flap may well be made inside the hairy scalp, as the scar will be then hidden by the growth of the hair (fig. 13, page 81, right hand figure).

The scalpel should cut right down to the bone, and the flap (including the temporal muscle and







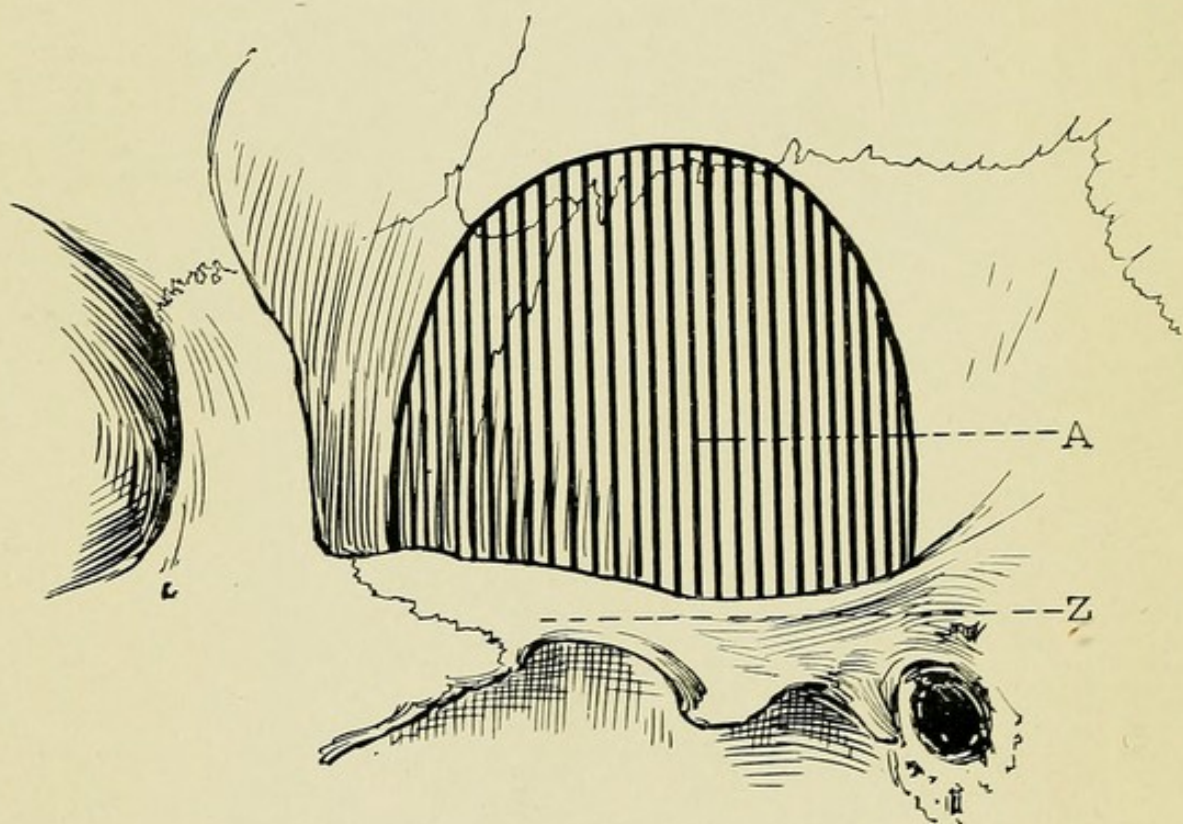


FIG. 12.

The bony floor of the temporal fossa. A.—(Shaded area) represents the part cut away in the Hartley-Krause operation. Z.—The zygoma.



the pericranium) is at once reflected by means of an elevator. The severed branches of the temporal artery are secured with Wells' forceps.

The pin of the trephine is now inserted midway between the external auditory meatus (its upper border) and the external angular process of the frontal bone, and, with every precaution, the disc of bone is cut and removed. It is of great

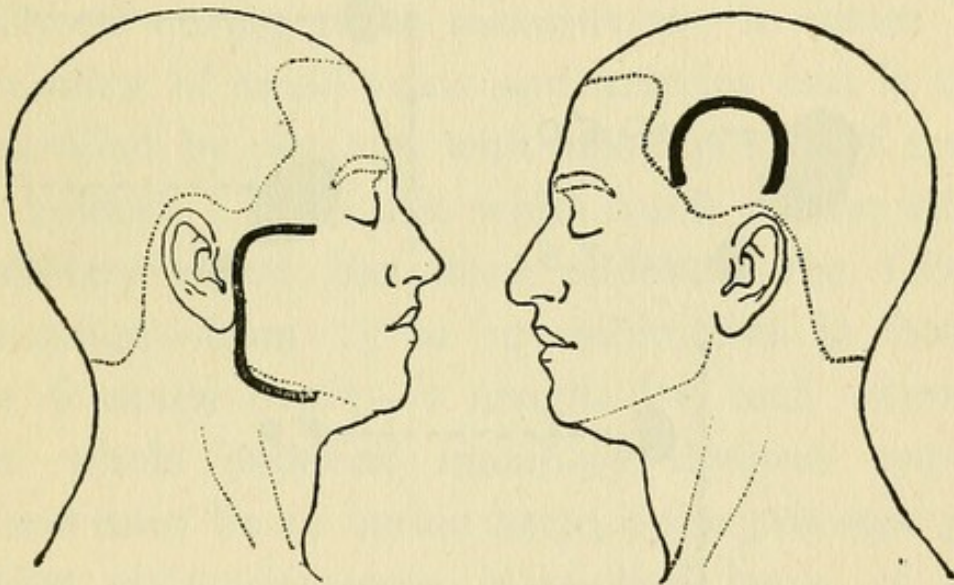


FIG 13.—Outline of horseshoe flap shown in right hand figure. On the left hand figure the facial incision for Rose's pterygoid operation is shown.

importance not to damage the dura mater or the anterior branch of the meningeal artery, and no instrument can surpass the ordinary trephine, guided by the surgeon's hand. The skull here is thin, but fairly uniform; the part removed is from the squamous portion of the temporal bone. With a blunt elevator the dura is now carefully detached inwards all round the aperture, but especially at its lower margin.



Hoffmann's forceps are used to enlarge the opening as far inwards as the infra-temporal crest. It is important to reach this line, but unnecessary to go further inwards in cutting away the bone (fig. 12).

The next step is to make for the foramen ovale by continual detachment of the dura from

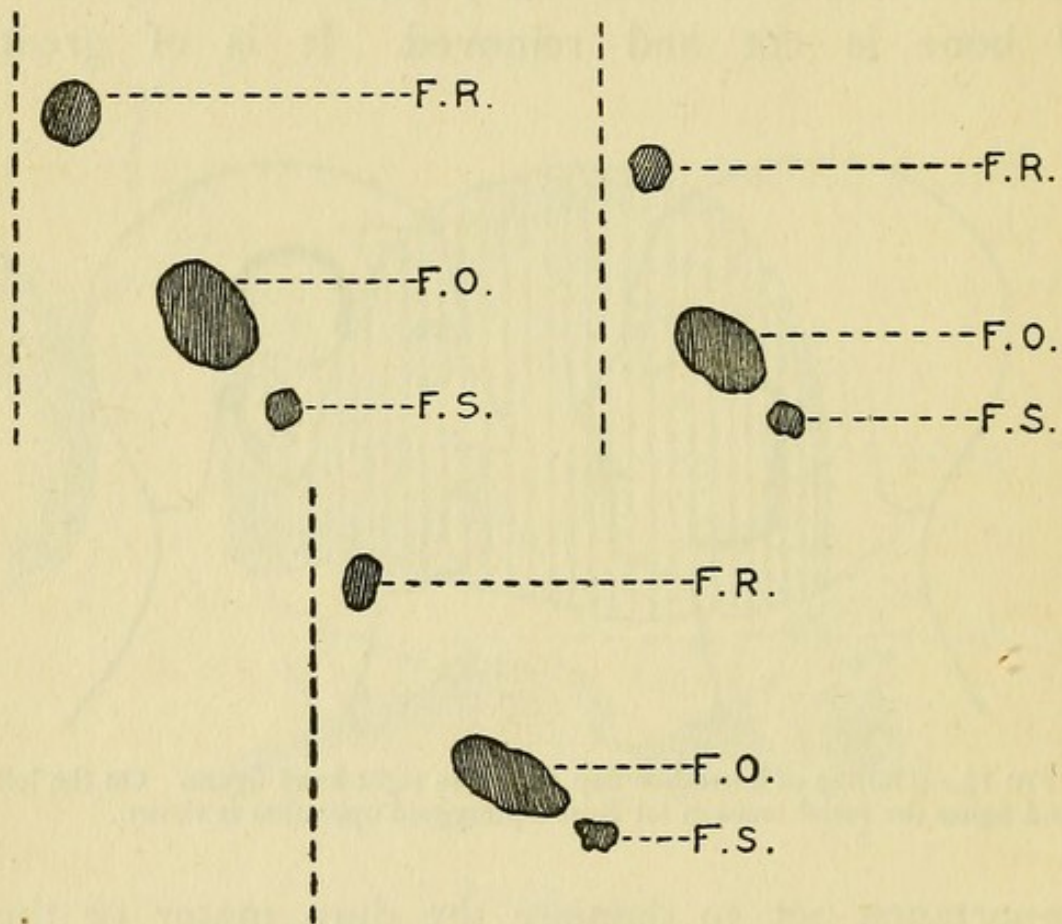


FIG. 14.—The relative positions of the three openings in the base of the skull in different subjects. F.R., foramen rotundum; F.O., foramen ovale; F.S., foramen spinosum. Note the variation with regard to the antero-posterior plane (dotted line), and the different sizes of the apertures. These were selected from the examination of many adult skulls as representing the chief variations that are to be met with.

the floor of the middle fossa and its elevation by the retractor. An useful landmark for the foramen is the preglenoid tubercle on the zygoma. It is probable that the point of entrance of the menin-



geal artery (the foramen spinosum) will be reached first; it lies from 1 to 1.5 millimetres behind, and a little to the outer side of, the inferior maxillary division (see F.O. and F.S. in fig. 14).

There is a certain range of variation in the size, shape, and relative position of the three foramina, a point illustrated by fig. 14, in which the openings are drawn exactly the natural size.

A variable amount of hæmorrhage will have occurred during these manœuvres; it comes from a number of small veins and arteries and is to be controlled by pressure with small pieces of sponge on holders. After the white trunk of the inferior maxillary nerve has been exposed, the foramen rotundum—from 15 to 20 millimètres in front of the foramen ovale—is sought for, and, ultimately the whole superior maxillary division exposed. There must be no undue haste, a few minutes' pause whilst sponge-pressure is applied being of much use, and a strong light must assist the operator's work. Above all, it is essential that the assistant who uses the retractor must be light-handed; the less the pressure upon the temporo-sphenoidal lobe of the brain the better.

Now comes the most difficult part of the operation, the exposure of the Gasserian ganglion, which it is useless to attempt until the bleeding has practically stopped. With the "fine elevator," the thin, dural sheath is carefully detached in an upward and backward direction, following the two



main nerve trunks (see fig. 15). In some cases it is impossible to expose the ganglion sufficiently without tying and dividing the middle meningeal artery. To do this the dura should be isolated all round the foramen spinosum, and the aneurism needle (threaded with fine silk), passed round the artery. The loop of ligature is then caught with a fine-toothed forceps and drawn towards the surface; a double ligature is then applied, leaving room to divide the artery between the two knots; slipping of the ligature is apt to occur unless this is carried out with great care. Should this accident happen, the foramen spinosum should be plugged with a minute fragment of bone driven well in.

It will be understood that the outer layer of the ganglion sheath is alone detached; its adhesion is always close, and cerebro-spinal fluid often escapes from a small puncture. This is of no great importance. When the ganglion has been thoroughly exposed, so that the section shown by the dotted line in fig. 15 can be made, *and not before this*, the superior and inferior, maxillary divisions are cut cleanly across just at the foramina ovale and rotundum. The best instrument for this is a narrow cataract knife or tenotome. The ganglion being firmly held by the toothed forceps is now divided high up, as shown in figs. 15, and 81, the ophthalmic division is left intact. The hæmorrhage is sure to increase at this point, but all difficulty is over and the retractor pressure should



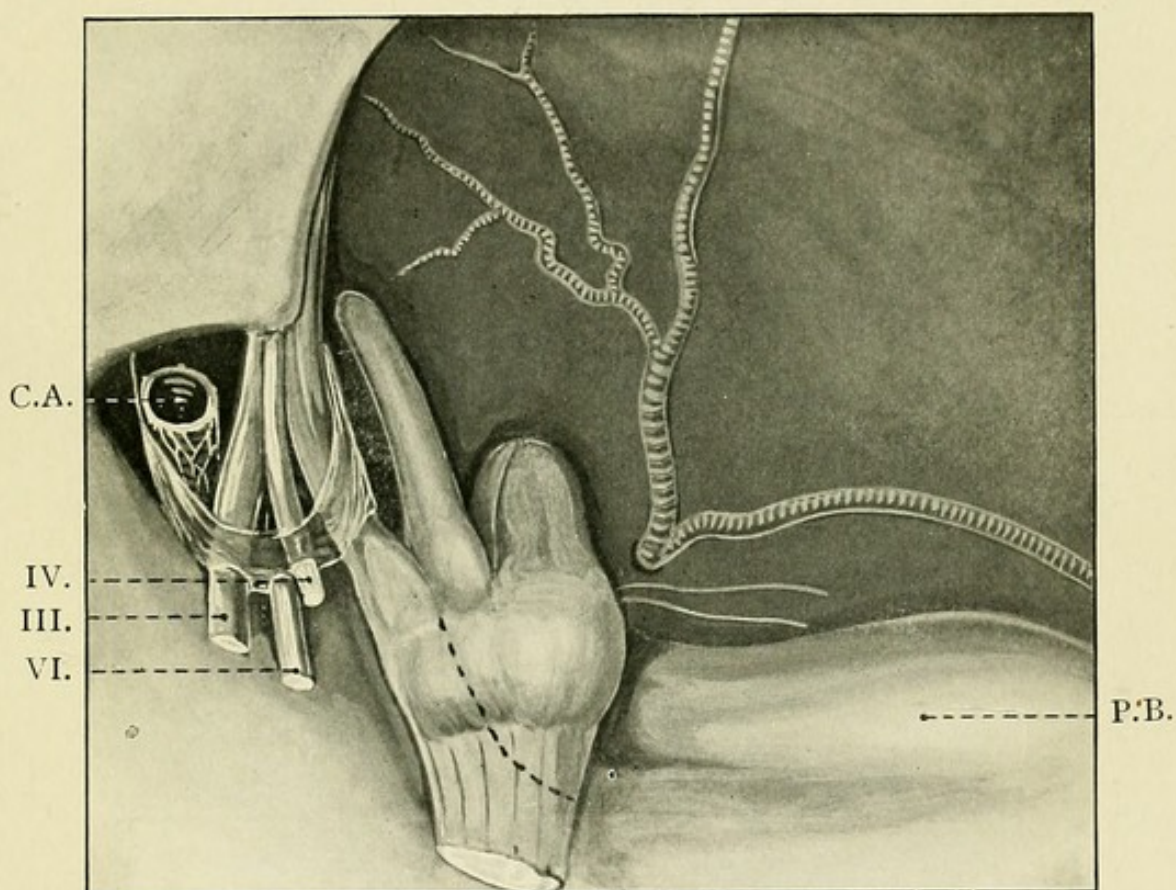
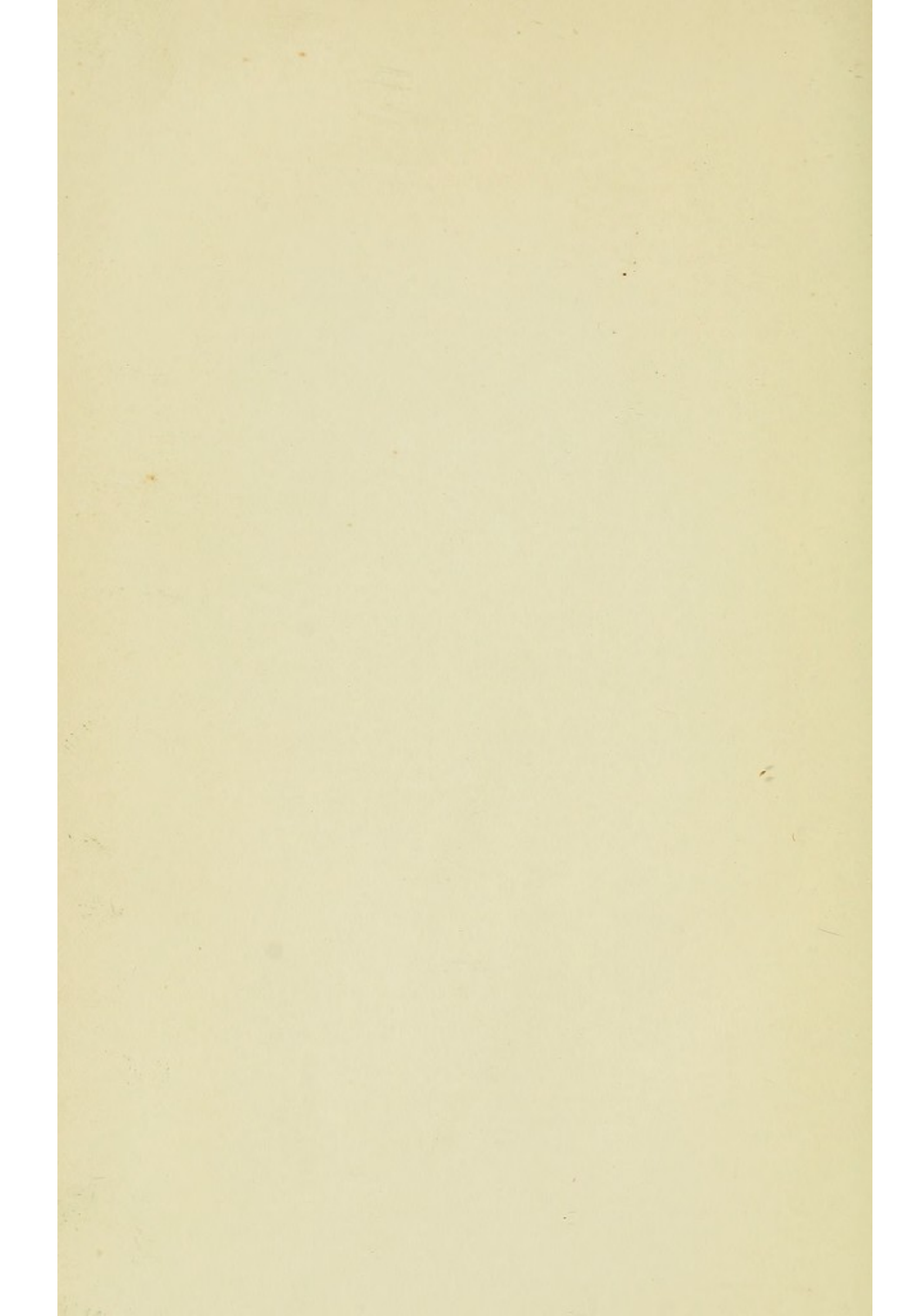


FIG. 15.

The cavernous sinus and Gasserian ganglion seen from above. P.B.—The petrous bone. C.A.—Carotid artery. III., IV. and VI.—The oculo-motor nerves showing their relation to the ophthalmic division of the fifth nerve. The relative position of the middle, meningeal artery and the inferior, maxillary nerve is shown. The dotted line crossing the Gasserian ganglion represents the section advised in removing the latter, together with the superior and inferior maxillary trunks. (From a model in the London Hospital Museum.)







at once be left off. *On no account should the wound be forcibly plugged with sponge or gauze.* A sterilised solution of adrenalin may be of use, the minute pieces of sponge being dipped in it.

Patience and a good light are the chief essentials for a proper section and removal of the ganglion; the operator must see exactly what he is cutting, and must remember the close proximity of the cavernous sinus.

The patient's head is now turned a little on the side so that blood can run out easily, a small spiral drainage tube is inserted, and the flap sewn in place; no bone is replaced. A large sterile dressing is then secured firmly to the head with a muslin bandage; the tube should be removed next day.

*After Treatment.*—If the patient has been addicted to morphia until just before the operation, it is sometimes advisable to give a hypodermic injection on the night following it. If there is evidence of marked shock, strychnia should be injected. In several of my cases shock has been conspicuously absent, the patient being able to sit up in bed on the day following the operation. The wound has, in every case, healed by first intention. Suppuration is, of course, a most dangerous complication, and hence the most sedulous care should be taken in previous disinfection of the scalp, and in all aseptic details of the operation.



Sir Victor Horsley<sup>1</sup> notes that bleeding from the meningeal artery can be "easily controlled by simply tipping in the lower end of the retractor so as to kink the artery as it leaves the foramen spinosum."

He advocates tearing the roots from the pons, a procedure which of course always paralyses the ophthalmic division. Many other surgeons carry out this complete removal, which, for reasons elsewhere given, I deliberately avoid, though in exceptional cases (where the neuralgia is severe in the ophthalmic distribution) it is certainly justified. Sir Victor Horsley's method differs from that given above in the last stage only. "The anterior and superior borders of the ganglion having been defined with a seeker and raised by pulling up from its bed, it is then separated by dividing the inferior division, then the middle division, and, finally, by detachment of the superior division of the ganglion. The ganglion is then steadily drawn upon until it is found that the sensory and motor roots have become detached from the pons, and are extracted in its full length. This is followed usually by a free flow of cerebro-spinal fluid, &c."

Various points in connection with the operation and its modifications require notice. The following are the chief ones :—

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<sup>1</sup> Horsley, *Clinical Journal*, November 3, 1897.



I.—*Should the Operation be done in One or Two Stages?*

The long duration of the operation has naturally led some surgeons to divide it into two stages, separated by a few days' interval. Severe hæmorrhage during the exposure of the ganglion *may* necessitate this course, but in Krause's opinion the operation should be completed in one stage if possible. The risk of failure to procure asepsis is thereby diminished, and the patient spared the shock of two operations and a double anæsthetic. Codivilla, in one case, met with such hæmorrhage from rupture of the meningeal artery, that he was obliged to plug the wound, and postpone the conclusion of the operation for three days. On the second occasion the bleeding was again severe, but, fortunately, the operation was brought to a successful issue. It is not only arterial but venous hæmorrhage that may be so severe as to compel the operator to postpone the completion of the operation. Of this, Mugnai records an example. Plugging the cavity with gauze or sponge appears to be attended with special risk; the pressure on the brain may cause aphasia or other paralytic symptoms, and the risk of sepsis is certainly much increased.

The answer to the question proposed above therefore is that whenever possible the operation should be completed at one sitting, but that when exceptional difficulty arises from hæmorrhage in exposing



the ganglion, it is wise to defer its completion for a few days.

## II.—*The Section of the Skull.*

With regard to the exact amount of bone divided or removed, a great deal of misplaced ingenuity has been expended, and the long descriptions by various surgeons of "their own methods of operating" only cause annoying and useless confusion in the reader's mind. For example, "Sapersko's method" includes ligature of the common carotid artery (with grave risk of hemiplegia), and division of each end of the zygoma (with the chance of necrosis—and, in any case, unnecessary). "Doyen's operation" included an extravagant skin incision, which passed for some inches onto the face; division of the zygoma and coronoid process; removal of the skull wall as far inwards as the foramen ovale—in fact, an increase in the severity of the operation which had no compensating feature. Of Doyen's three cases reported, two were fatal as a direct result of the operation—a sufficient condemnation in itself.

It is unnecessary to describe the so-called "Quénu's operation," and the height of absurdity is reached by such terms as the "Doyen-Quénu-Sébileau-Poirier method," which is gravely referred to by another French writer on the subject. There is a sad lack of humour in some surgical authors.

Division of the zygoma has been employed by







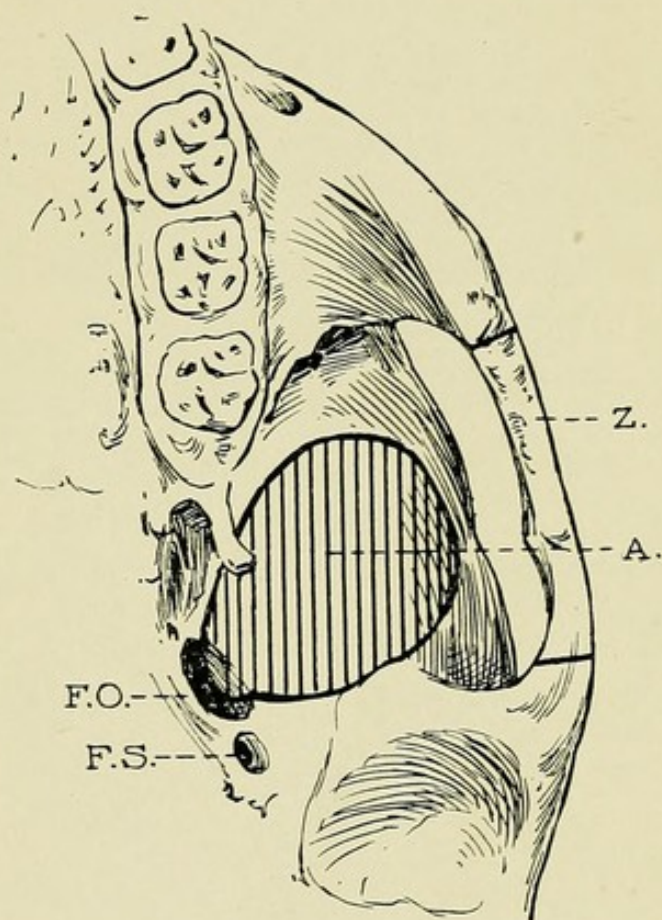


FIG. 16.

Z.—The zygoma. F.O.—Foramen ovale. F.S.—Foramen spinosum.  
 A.—(Shaded area) represents the part of bone cut away in Cushing's or Poiriers' operation.



many surgeons as an aid to the free removal of bone from the side of the skull ; it must be quite exceptional for this to be necessary. Dr. Cushing,<sup>1</sup> of Baltimore, advocates the following method, which he states he has carried out successfully in thirteen cases :—

The usual horse-shoe flap, with its base at the zygoma, is turned down ; the zygoma is divided at each end, and also reflected with the masseter muscle. The great wing of the sphenoid and the temporal bone is then cleared as low as the origin of the external, pterygoid muscle. A small orifice is then made in the most prominent part of the sphenoid wing, the opening being enlarged with the cutting forceps until it is 3 centimètres in diameter. The dura mater being detached and pushed upwards, the surgeon works inwards and backwards so as to expose the foramina rotundum and ovale. Cushing advocates removal of the entire ganglion with the ophthalmic division. The zygoma is subsequently fixed in place (fig. 16).

Cushing's method, it will be seen, is in some respects a reversion to Rose's original operation, in that the opening in the skull is made low down, and the zygoma is divided. He claims for it two advantages over the Hartley-Krause method ; first, a more direct access to the ganglion, and

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<sup>1</sup> Cushing, *Journal of Amer. Med. Assoc.*, April 28, 1900, p. 1035.



secondly, the avoidance of the middle meningeal artery. As noted elsewhere, the latter vessel may be avoided also in the usual temporal operation. The division of the zygoma is a distinct drawback, and, in addition, the coronoid process of the lower jaw comes in the way. That Cushing's slight modifications present any real gain may well be doubted, and the complete removal of the ganglion with its ophthalmic division, which he recommends, is certainly unnecessary in most cases, and may lead to the subsequent loss of the eye.

In all essentials what has been described as Cushing's method is identical with M. Poirier's procedure, details of which were published three years before,<sup>1</sup> *i.e.*, in 1897. There is the same oval flap, the same division and downward displacement of zygoma, section of temporal muscle and detachment of external pterygoid, exposure of foramen ovale, trephining of bone forming the roof of the zygomatic fossa, and removal of the whole ganglion. The only possible difference that the careful reader will find, is that Poirier removes rather more bone, thus giving better access to the ganglion. It is at least strange that Mr. Cushing and Professor Kocher (who writes of the former's modification as original, and constituting a great

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<sup>1</sup> Poirier's method is figured and described in detail in Chipault, *Chir. Nerveuse*, vol. i., pp. 394 to 398. It was published before this in the *Trav. Neur. Chir. Chip.*, 1897, ii., 213.



improvement) do not mention Poirier's work. The dispute as to priority on such a matter is, however, hardly worth raising.

### III.—*The Osteoplastic Method.*

Many surgeons have turned down a quadrangular flap of bone with the soft tissues instead of trephining. This method necessitates making four small apertures in the bone to correspond with each angle of the flap; the sides may be divided with a chisel, or cut entirely from within outwards by means of a fine Gigli's saw. The advantage of replacing the bone may well be questioned. The aperture made by trephining is soon closed up largely or entirely by bone, so that a few months later the intracranial pulsation can hardly be detected. I have never known the slightest complaint made by the patient with regard to the supposed weak spot. On the other hand, if a large osteo-plastic flap is made, more free access to the middle fossa is probably secured than by trephining. This is the sole advantage that can be claimed.

The following points may be urged against the method :—

(1) In the manipulations carried out with the drill or small trephine, the chisel, and the saw, and in the necessary detachment of the dura mater, the latter is extremely apt to be torn and bruised.



(2) The middle meningeal branches are easily damaged<sup>1</sup> and will give considerable trouble ; many cases of this could be quoted.

(3) Even more serious damage may be done to the brain ; thus, W. W. Keen, in perforating the skull with a Cryer's drill, experienced free hæmorrhage " from a branch of the middle cerebral artery " and an extensive clot formed. The patient was hemiplegic after the operation, and died on the third day.

(4) The flap is decidedly in the way during the later stages of the operation.

(5) After all his time and trouble spent in turning down the flap of bone, the operator may decide that it is unsafe to replace it, owing to separation of the pericranium,<sup>2</sup> or other cause.

(6) Probably the replaced bone will survive, but this is not certain, and its necrosis is a most dangerous complication, as septic meningitis is almost inevitable.

For the above reasons it appears best not to employ the osteo-plastic flap, though the surgeon's predilections must decide this. Should it be used, the greatest care should be taken in detaching the dura mater so as not to tear the meningeal artery,

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<sup>1</sup> e.g., cases recorded by S. P. Weeks, *Trans. Amer. Surg. Assoc.*, 1897, p. 171, and W. W. Keen, *Amer. Journal of Med. Science*, 1896, cxi., p. 68.

<sup>2</sup> As in a case operated on by J. Raum, in 1897, quoted in Chipault's *Chirurgie Nerveuse*, vol. ii., p. 192.



and the chisel alone should certainly not be used for the entire section of the bone. All the electric drills and cutters are unsafe as being difficult to control, and apt to slip through the dura mater into the brain. Professor Krause uses Doyen's perforator to make two openings at the upper angles of the flap ; with Dahlgren's cutting forceps he then completes the upper section and also divides the bone down to the level of the zygoma. A spatula being passed between the bone and dura, the former is grasped by forceps and bent downwards so as to fracture it transversely, opposite the zygoma. With cutting forceps the portion of squamous bone and great wing of the sphenoid, between the line of fracture and the infra-temporal crest, is then excised bit by bit. Krause points out that it is essential to remove the bone as far inwards as the crest, but unnecessary to go further. "As to resection of the zygoma it is absolutely useless." Chipault, however, writing in 1904, says that, in France, all operators on the Gasserian ganglion employ some method involving division of the zygoma, and that the simple temporal route finds no advocates there. It is of special interest to note that Chipault speaks of the mortality of operations on the ganglion as being enormous!<sup>1</sup>

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<sup>1</sup> Chipault, *Etat Actuel de la Chir. Nerveuse*, 1904, vol. ii., p. 404.



#### IV.—*The Question of Ligature of the Meningeal Artery.*

It is possible to remove the Gasserian ganglion without division of this artery; but undoubtedly its division between two ligatures allows of the dura mater being lifted up more completely, and Krause has carried this out in all his operations, and recommends that it should always be done. There are certain variations in the position, &c., of the foramen spinosum through which the artery enters the skull. Thus in three of his twenty-five cases Krause found a double foramen, through which the two main arterial branches, anterior and posterior, passed. The usual position in the adult skull for the spinous foramen is 2 millimètres behind, and about 1 millimètre outside the foramen ovale (see fig. 14, page 82).

An aneurism needle with a short, sharp curve is necessary; it should be threaded with fine silk, which is less likely to slip than catgut. The dura mater ensheathing the vessel must be carefully detached upwards, so that a space is obtained between the two ligatures. With the greatest care, however, one or other ligature is apt to slip off. In this case Krause recommends that a rectangular hook should be pressed down into the foramen spinosum. Horsley's aseptic wax may be used.

I have succeeded in dealing with the ganglion



satisfactorily, in one or two cases, without dividing the meningeal artery, but this certainly cannot always be done. Out of twelve cases operated on by Italian surgeons, formal ligature of this vessel was found to be necessary in nine.

V.—*Plugging the Foramina Rotundum and Ovale.*

Dr. Robert Abbe (*Annals of Surgery*, 1903) points out that the mortality following the operations on the Gasserian ganglion has been needlessly high, owing to the assumed necessity for removal of the whole ganglion. He urges that there is no need for removal of the ophthalmic division in the great majority of cases, and he thinks that section of the second and third divisions, with the interposition of a small piece of sterile rubber between the dura mater and the foramina rotundum and ovale, will suffice to obtain a cure. The object of the insertion of the rubber disc, which is, of course, left *in situ*, is to prevent reunion between the nerves and the ganglion, and from the record of five cases which he reports he shows that the pain did not return during periods of from six months to six years. He also urges that the method is simple, speedy, and safe.

With regard to Abbe's contention, the writer heartily agrees in limiting the interference in most cases to the lower part of the ganglion, with its second and third divisions. By this means the



mortality from shock will be lessened, as well as the danger of injuring the cavernous sinus and the oculo-motor nerves. At the same time Abbe's method differs only from the ordinary one, described in detail in this work, by the interposition of the rubber disc, and therefore no special merit of simplicity or safeness can fairly be claimed for it. The rubber disc is probably of little or no value, for the following reason: Supposing that, after complete section at the ganglion, physiological reunion were to occur, we should of course find that the parts made anæsthetic by the operation, such, for example, as the cheek and hard palate, would regain sensation. In no single case that the writer has followed up, or has found recorded, has this result occurred; hence, Dr. Abbe seems to be providing against an imaginary risk. When the lower part of the ganglion and its main branches are cut, regeneration no more occurs than after section of the spinal nerves in a corresponding position. It is worth noting that Abbe considers a vertical incision over the temporal fossa affords, with strong retraction, as good access as does the usual one employed, and that he regards preliminary ligature of the external, carotid artery as being of advantage in controlling hæmorrhage. He believes that in epileptiform neuralgia there is a neuritis in front of the ganglion in some parts of the peripheral branches; but, with regard to this point, his evidence is far from conclusive.



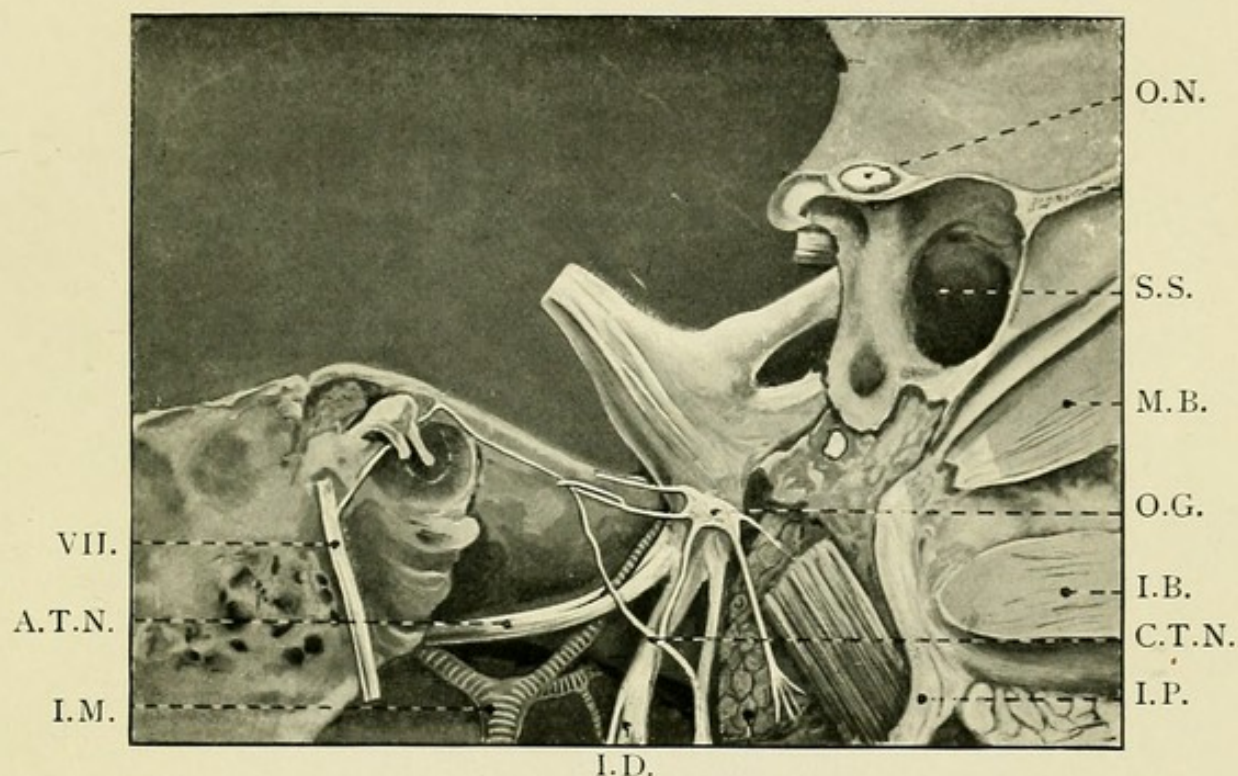
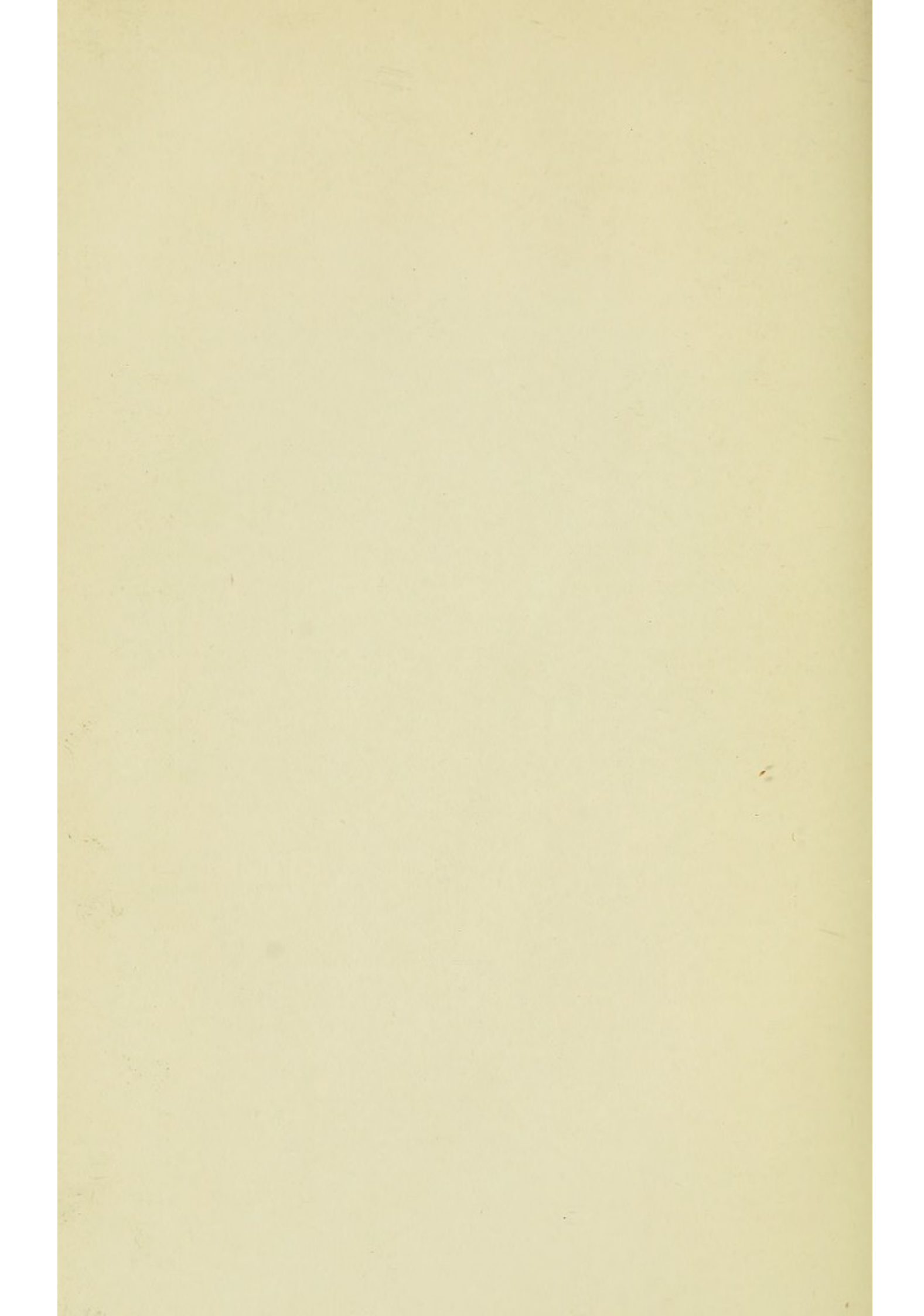


FIG. 17.

The Gasserian and otic ganglia viewed from the inner side (from original dissection in the London Hospital Museum). The course of the motor root to its complete union with the inferior maxillary division and the main branches of the latter are shown. O.N.—Optic nerve. S.S.—Sphenoidal sinus. M.B.—Middle turbinated bone. O.G.—Otic ganglion showing its branches to the pterygoid muscles, the chorda tympani, &c. I.B.—Inferior turbinated bone. C.T.N.—Chorda tympani nerve. I.P.—Internal pterygoid plate. I.D.—Inferior dental nerve with mylo-hyoid branch. VII.—Facial nerve. A.T.N.—Auriculo-temporal nerve. I.M.—Internal maxillary artery.







Moreover, simple section of the main trunks below the ganglion, as advised by Abbe, is probably less certain to effect a cure than the removal of most of the ganglion.

Chipault has tried plugging the foramina rotundum and ovale with dentist's stopping material, with the view of intimidating the fifth nerve.

#### VI.—*Division of the Sensory Root alone.*

It is much to be wished, in operating on the Gasserian ganglion for neuralgia, that the motor root, which is in no way concerned, could be spared. It is, however, impossible to effect this in Krause's operation, so intimately blended with the ganglion and the third division is the slender motor root (fig. 17 illustrates this well). Above the aperture in the dura mater it is possible, though extremely difficult, to isolate the sensory root and to divide it alone. This procedure was carried out, in one case, with apparent success, by Spiller and Frazier. They dissected down to the ganglion after the usual method, then divided the dura mater, isolated the sensory root, and, hooking it outwards, cut it across. In some respects their method followed that employed by Sir Victor Horsley, in his solitary case of intradural division of the ganglionic roots; only, they spared the motor one. The fatal result in Horsley's case deterred subsequent operators, and the uncertainty of Spiller



and Frazier's method will, we think, have the same effect. It is, however, probable that many surgeons will attempt the division of the sensory root above the ganglion, since during the last year it has been suggested in many quarters ; and, it is to be feared that, if this should happen, discredit will be brought on the whole subject of operations on the Gasserian ganglion. The sole recommendation is the preservation of the motor root, an extremely difficult proceeding when cerebro-spinal fluid and blood are harrassing the operator. It is of interest that, in the analogous operation of division of the auditory nerve for vertigo, the facial trunk has more than once been cut also, though the distinction between them is easier to make out than that between the two parts of the fifth nerve. Repeated experiment has convinced me that, in the *cavum Meckelii*, it is impossible to divide the sensory portion completely without sacrificing the motor root (see fig. 18) ; above the *cavum* it is so difficult as to depend almost upon chance. Professor Krause, after fruitless attempts to preserve the motor root, when dealing with the Gasserian ganglion, has quite given them up, and remarks that the trouble caused by one-sided paralysis of the masticatory muscles is insignificant.



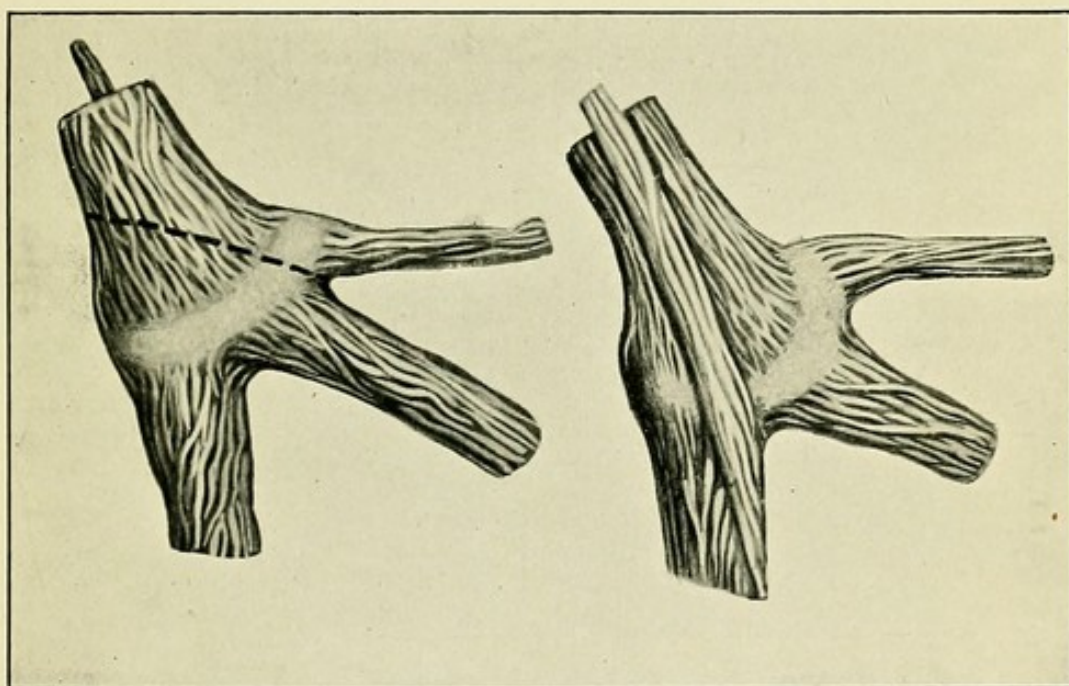


FIG. 18.

The Gasserian ganglion, viewed from the external and internal surface. The motor root is seen to lie on the median aspect of the sensory one to which it closely adheres, becoming completely incorporated with the front of the internal maxillary division. The dotted line on the left figure shows the section advised to spare the ophthalmic division. (Modified from Rüdinger.)







## VII.—*Ligature of the External Carotid.*

It is natural to suppose that one of the main difficulties of the operation, namely hæmorrhage, would be materially diminished by preliminary ligature of the external carotid artery ; but so free is the collateral circulation that even the arterial bleeding seems to be but little affected by this procedure. I have only once employed it, but in this case, the ligature being performed in the middle of the operation, no apparent effect was produced. G. R. Fowler tied the external carotid, as a preliminary measure, in two cases ; in one, "abundant bleeding occurred, as the dura mater was separated from the middle fossa," and the completion of the operation had to be postponed. Unfortunately, his patient died from septic infection following plugging with gauze. In the second case the bleeding was insignificant. Keeping the patient in an upright, sitting posture is far more effective than ligature of the external carotid, since it checks both venous and arterial bleeding.

It is curious that *ligature of the common carotid* should have ever come into vogue as a treatment for intense neuralgia of the fifth nerve. On no physiological theory could the impairment of blood supply be likely to suppress pain, especially if, as Keen has urged, the blood-vessels of the ganglia are already narrowed by disease. A wide experience of the operation has shown that, in some



cases, temporary relief is afforded; in the case of one patient<sup>1</sup> the pain only recurred after three or four years' interval, but in the majority there is not even a temporary cure. Moreover, the danger of hemiplegia following ligature of the common carotid artery, especially in old subjects, is too great to justify its being run without the gravest cause. As a method of treating epileptiform neuralgia, arterial ligature should, therefore, never be resorted to.

The same remark holds true for excision of the cervical sympathetic ganglia, which, by certain writers, has been advocated as a kind of surgical panacea. It could not be expected to succeed in cases of neuralgia, and, experience has shown that it does not succeed. Chipault is one of the very few writers who has tried to make out a favourable case for it<sup>2</sup>; he had been so impressed with the "enormous mortality" of operations on the Gasserian ganglion that, in 1902, he had only performed three such operations and preferred any alternative method.

#### VIII.—*The Pterygoid Route from Below.*

To Professor Wm. Rose belongs the credit of having first operated on the Gasserian ganglion

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<sup>1</sup> Dr. J. C. Hutchinson's case, briefly reported in *Trans. of Am. Surgeons' Assoc.*, 1884, p. 489.

<sup>2</sup> Chipault, *Etat de la Chir. Nerveuse*, 1902, vol. i., p. 443.



from the under surface of the cranial base. His method, which was followed by a number of other operators, is a most elaborate and difficult one. Undoubtedly, in some cases, the ganglion was reached and excised with success, but the following objections have led to its abandonment in favour of the temporal route:—

(1) The division of bone required—the zygoma and coronoid process—was sometimes followed by necrosis, non-union, or by stiffness of the jaw, with marked deformity.

(2) The hæmorrhage was often severe and difficult to control.

(3) The view afforded of the ganglion was inferior to that obtained by the temporal route. It is certain that many operators failed entirely to deal with the ganglion by Rose's method; hence recurrence of the neuralgia was not infrequent.

(4) The Eustachian tube is in special danger of being injured; this may be a serious complication.

Thus Caponotto, an Italian surgeon, records a case in which the operation was followed by marked rise of temperature, and bleeding from nose and mouth. At the autopsy, five days later, it was found that the Eustachian tube had been wounded and that meningitis had ensued.

It has been already noted that Poirier's or Cushing's operation is a compromise between



Rose's and the Hartley-Krause method, and it is curious that a partial reversion to Rose's operation should be advocated, after it had been abandoned by all authorities. Professor Rose himself<sup>1</sup> ultimately gave up operations on the Gasserian ganglion and advocated extensive resection of, first, the superior maxillary nerve, and secondly (after an interval of a few weeks), of the inferior maxillary division. He stated that it was hardly ever necessary to touch the ophthalmic division. This conclusion agrees exactly with the operation advocated in this work; only, for two extracranial operations a single intracranial one is substituted, which deals only with the lower part of the Gasserian ganglion and the two main trunks issuing from it.



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<sup>1</sup> W. Rose, *The Practitioner*, 1899, p. 255.



## CHAPTER VI.

### EXCISION OF THE GASSERIAN GANGLION. RESULTS AND COMPLICATIONS OF THE OPERATION.

WE have to consider first the conditions which result from a successful removal of the ganglion. The question of subsequent disfigurement is one to which some importance may be attached, as after the old pterygoid operation from below the face was left extensively scarred, and when the zygoma was divided, it did not always unite in good position. But when the temporal (Hartley-Krause) operation has been performed there is remarkably little disfigurement, the scar being usually hidden entirely by the scalp; there is merely some flattening of the temporal region, due to atrophy of the underlying muscle.

The amount of cutaneous anæsthesia depends, of course, upon whether the whole ganglion has been removed, or its ophthalmic division spared. In the former case the skin will be anæsthetic from the chin to high up on the forehead, and from the middle line to the temporal fossa. The greater part of the ear and the masseteric region will always retain sensation, owing to their supply from ascending nerves from the superficial cervical



plexus. These points are illustrated by fig. 19, taken from one of my cases.

If the ophthalmic division has been spared, the forehead, the greater part of the nose, the upper

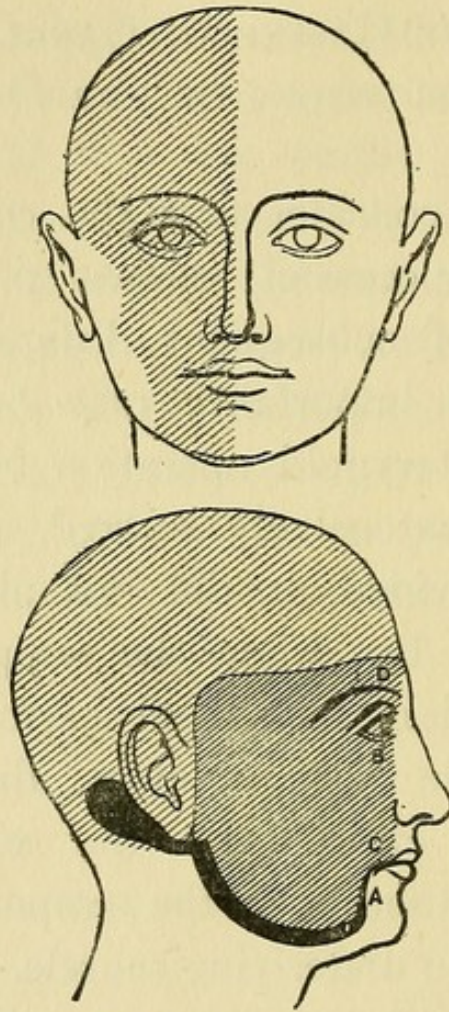


FIG. 19.—Distribution of the neuralgia (lower figure) and anæsthesia left after complete removal of the Gasserian ganglion (upper figure). In this case the pain was greatest in the parts deeply shaded; the letters A B C D mark points of especial tenderness. In the upper figure it is seen that the ear and masseteric regions retain sensation.

eyelid, and (most important of all) the cornea and conjunctiva will retain their sensation. The anæsthetic area is then as shown in fig. 20. It will be noticed that there is a small prolongation of the insensitive area at the front of the external



auditory meatus; this is prolonged in the upper and anterior wall of the meatus itself.

Dr. Cushing states that this area includes a small portion of the tympanic membrane. As regards the mucous membrane of the mouth, &c., the anæsthesia will be complete on the inner sur-

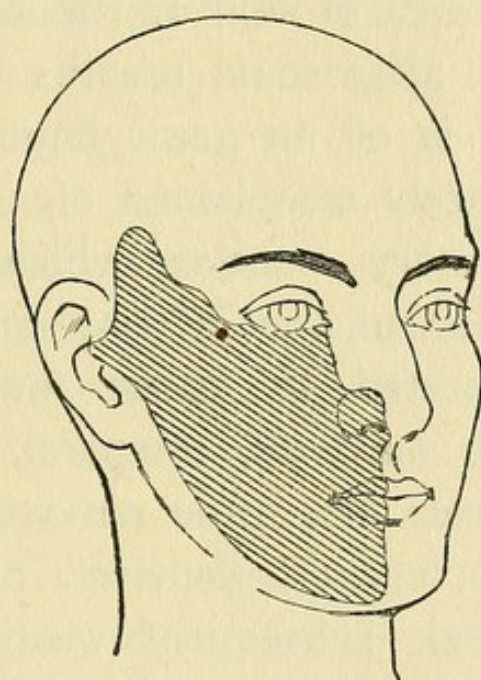


FIG. 20.—Area of cutaneous anæsthesia left after excision of the Gasserian ganglion (the ophthalmic division being untouched). Taken from a case six months after operation.

face of the lips, the gums, and hard and soft palate. It is less complete on the anterior two-thirds of the tongue (owing to the chorda tympani containing sensory fibres), and in the pharyngeal vault. Sensation in the Eustachian tube is much impaired, and the nasal cavity is insensitive to touch, though, of course, the sense of smell is retained.

Dr. Cushing (*Johns Hopkins Bulletin*, 1904) has made careful and elaborate investigations of



the anæsthetic area in cases of extirpation of the Gasserian ganglion. As might be expected, there is a small range of variation in different subjects, but his main results agree with the statements made above.

Does the area of anæsthesia decrease? In some cases, possibly in all, a slight reduction in the anæsthetic area of skin and mucous membrane can be proved after some months or years have elapsed. This is of no great importance, as the numbness is rarely complained of. The paralysis of the masticatory muscles, which must follow complete division of the inferior maxillary trunk, might be expected to cause far more inconvenience. The masseter, temporal, and the two pterygoid muscles are, after removal of the Gasserian ganglion, entirely deprived of their nerve-supply, and their subsequent wasting can easily be proved. It is strange how little trouble is caused thereby, as the muscles of the opposite side amply suffice for mastication. In every case the patient eats better than before the operation, since no longer does the attempt at chewing the food bring on spasms of pain. When questioned on the point the patients state "they can now eat anything."

Is the sense of taste impaired by the paralysis of the so-called gustatory nerve?

It is certain that the "gustatory" nerve has nothing to do with the sense of taste in the



posterior third of the tongue (the region of the circumvallate papillæ) the glosso-pharyngeal transmitting it from this part. With regard to the anterior two-thirds of the tongue, it is generally admitted that the taste-organs are supplied by the chorda tympani nerve, which reaches the facial, and undoubtedly ascends to its geniculate ganglion. After this point the further course of the fibres is doubtful, the most probable being the pars intermedia of Wrisberg, and so to the brain. Dr. Harvey Cushing, in an elaborate paper, with many references,<sup>1</sup> discusses the question, and comes to the following conclusion: "That the perception of taste is unaffected on the posterior portion of the tongue, and never permanently or completely lost on its anterior two-thirds after removal of the Gasserian ganglion."

Dr. Cushing noted in one or two of his cases that the sense of taste was dulled for a time in the front part of the tongue after the operation, and suggested that this was due to "some interference with chorda transmission, brought about by a mechanical or toxic disturbance, due to degeneration of the lingual or gustatory nerve." Cushing's view is, however, directly opposed by the evidence of several observers.<sup>2</sup> In one case

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<sup>1</sup> Cushing, *Johns Hopkins Hospital Bulletin*, March, 1903, p. 71.

<sup>2</sup> e.g., A. Guinard.



in which I had removed the lower two-thirds of the ganglion some months previously, the patient had certainly lost the power of distinguishing quinine, salt, &c., on the anterior part of that side of the tongue. It was not merely that the sense of taste over this region was dulled (in Cushing's words): it was entirely lost. The case is detailed on p. 50. Thus, after excision of the Gasserian ganglion, permanent anæsthesia over a large area of skin and mucous membrane is left; the sense of taste is impaired on the side operated on; the masticatory muscles waste. Nevertheless, the patient experiences little, if any, discomfort from the loss of sensation; he is able to take food far better than before, and the disfigurement (if the temporal route has been followed) is trifling. There is, however, one point with regard to complete extirpation of the ganglion that deserves special note, namely, the risk of subsequent keratitis, and even loss of the eye.

*Neuro-paralytic Keratitis.*—This is a serious drawback to the operation of complete removal of the ganglion, the danger of which is entirely avoided in the modified method.

How frequently it occurs can hardly be estimated from the cases recorded, especially when they have been reported soon after the operation. In the only one of my cases in which the eye was ultimately lost, owing to spreading ulcer of the cornea, the trouble developed some months after the patient had left the hospital.



The patient was a man, aged 64, who was sent to me by Dr. Simpson. He had suffered for five years from severe epileptiform neuralgia. His paroxysmal attacks started in the lower jaw, spreading to the whole side of the cheek, the lower part of the forehead, and temple; they involved also the region behind the ear, and in a severe attack the whole of the right side of the scalp. This radiation of the pain to parts beyond the area supplied by the fifth nerve has been noticed in many cases, and does not contra-indicate excision of the ganglion, by which operation it is put an end to.

During the attacks there was usually marked lachrymation, and, more than once there had been conjunctivitis on the affected side. The pain was not controlled even by opium, and the patient's condition was a very miserable one. Excision of the Gasserian ganglion was performed in June, 1899, the chief difficulty met with being due to the extreme thinness of the dura mater. In raising this membrane from the middle fossa it was unavoidably torn, with the result that the cerebro-spinal fluid escaped. Owing probably to this fact, the pressure of the broad retractor exerted more deleterious effect on the brain than usual, and he had for some little time after the operation partial paralysis of the opposite arm and leg, which slowly improved. The wound healed perfectly and the neuralgia has been completely cured. His anæsthesia involves not only the right side of the tongue, palate, cheek, nose, &c., but also that half of the forehead, the cornea, and conjunctiva. With regard to the eye, all went on well until several weeks after he had returned home. He then developed keratitis, which slowly spread in spite of treatment, and ultimately, as the eye was useless, I excised it.

It is difficult or impossible to estimate the proportion of cases in which corneal trouble has followed the complete operation. Naturally, surgeons do not dwell on this complication when publishing



their experience. That the risk is a real one is shown by the following nine instances, which I have collected from various published records :—

(1) Biondi. Central ulcer of cornea with hypopyon two months after operation. The condition of the eye improved after a time, and apparently did not necessitate excision.

(2) G. Andrews (*Internat. Med. Mag., Philad.*, 1892, I., p. 486), "ulcers of the cornea appeared after the operation, when the aseptic compresses, which had been placed over the eye, were removed." It is probable that these ulcers were not due to complete corneal anæsthesia, since the ganglion was supposed to have been removed by the curette. The ulcers, moreover, soon healed, whereas the true neuro-paralytic ones are most obstinate.

(3) W. W. Keen (*Amer. Journal of Med. Sciences*, Jan., 1896). At the end of the operation the eyelids were sewn together; four days later they were separated, and a corneal ulcer made its appearance. The subsequent history is imperfect, but it would appear that the ulcer slowly improved.

(4) W. W. Keen (*Ibid.* November, 1898). The eye on the affected side "became blind."

(5) Davis (*Univ. of Pennsylvania Med. Bull.*, No. 2, 1904). Eight months after complete removal of Gasserian ganglion the anæsthetic eyeball had to be excised, owing to corneal ulceration.

(6) Gérard-Marchant (*Bull. de la Soc. de Chir.*, 1896, xxii., p. 585). A fortnight after the operation the cornea began to ulcerate, and it remained permanently opaque.

(7) A. Depage (*Bull. Acad. de Med. de Belge*, 1897, vol. 2, p. 687). "The cornea on the operated side ulcerated; there was conjunctivitis, and the sight was almost gone."

(8) S. Cœlho (*Révue de Chir.*, 1899, xix., p. 623). The ganglion was wholly removed by tearing through its roots. The cornea became opaque but subsequently cleared, "except for a small opacity."



(9) Bouglé (*Bull. de la Soc. de Chir.*, 1901, p. 403).  
Ulceration of the cornea followed with chemosis.

From the preceding ten cases it will be seen that whilst the danger is greatest, as Krause points out, during the first few weeks, yet an anæsthetic cornea can never be really safe. Septic dust may enter without being noticed and set up a chronic inflammation, which is very hard to check. To this cause must be ascribed the so-called trophic changes in the eye, and if the ophthalmic division has been dealt with and the cornea rendered permanently anæsthetic, the safest plan will be for the patient to wear protective glasses as a continual precaution. Sewing up the lids on the side concerned has been carried out by some surgeons, but this is an irksome measure, and, as already pointed out, the temporary closure of the lids affords no guarantee for the future.

Occasionally the eye-lesion takes the form of purulent conjunctivitis, leading later to ulcerative keratitis—from this Bouglé's patient was unfortunate enough to suffer. In such a case it is probable that the use of too strong antiseptic solutions for bathing the eye is responsible for the conjunctivitis—the surgeon's precautions having been too elaborate. A very mild antiseptic lotion may prove destructive to an anæsthetic corneal surface; but I would again urge that when the cornea has been rendered completely anæsthetic by removal of the entire Gasserian ganglion or section of its roots,



there will always remain some risk of "trophic" ulceration. The fear of eventually losing the eye is an important drawback to such an operation, a drawback which can be entirely avoided by limiting the excision of the ganglion in the manner described.

We will now consider the direct mortality of the operation—the actual risk to life which it involves.

Chipault wrote, in 1902, that the mortality of these operations "is enormous." How far can this statement be justified? Of Krause's thirty-six cases in which the ganglion was removed, six died, *i.e.*, 16 per cent. In three of these, however, the death was due to "influenza," or pneumonia (in one case following heart-failure). All these three patients died at the end of the third week after the operation, and it can fairly be said that the latter was only indirectly to blame, the shock which resulted, in feeble patients, hastening the end. Still, as most of the subjects are old, and many of them feeble, it is best fairly to state Krause's mortality as 16 per cent. Lexer lost one case out of twelve, of meningitis. At the *post mortem* of this case a tumour of the base of the skull was found. In a case of my own a cartilaginous tumour was found invading the Gasserian ganglion from the adjoining bone; complete removal was impossible. The patient recovered from the operation, which was, in fact, mainly exploratory. (See page 31.)



It is obvious that cases, in which the presence of a tumour complicates the operation, should not be counted with the ordinary ones. Lexer's eleven and my own eight cases amount to nineteen, without a single death. Sir Victor Horsley, in 1897, had done eight Hartley-Krause operations without a death. He kindly tells me that, since then, his personal experience has increased to approximately 120, with six deaths.<sup>1</sup> No other surgeon's statistics can, I believe, compare in number and lowness of mortality with Sir Victor Horsley's. Taking his cases with Lexer's and my own, we have 140 cases with six deaths, only 4 per cent., and this includes two fatal cases which some surgeons might have left out. The mortality, therefore, so far from being "enormous," as Chipault suggests, is very slight. What has given rise to the prevailing idea on the subject, which it is most important to dispel? The fact is that, in the past, the mortality has been far too high, owing to inexperience, and still more, to needlessly heroic or clumsy methods of operating. The collection of cases made by Keen, Tiffany, and others is easily consulted, and it, undoubtedly, shows a mortality of 20 per cent., or over. Such a heavy death-rate is, fortunately, quite

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<sup>1</sup> Of the six fatal cases, cerebral hæmorrhage was the cause in three; one patient died from septic infection (from a septic case in the same ward of the hospital). In the other two cases an interval of three or four months occurred after the operation, the cause of death being doubtful.



needless, but it has deterred many physicians from recommending the operation in suitable cases.

The following selection of fatal results has been made, solely for the purpose of illustrating the causes of death and the means of avoiding it, as far as possible. It would have been easy to extend the list, but for all practical purposes it is long enough. The reader will understand that in every one included the temporal route was adopted :—

*Fatal Cases. Hartley-Krause Method.*

(1) Bernandi. Aged 68. Severe hæmorrhage. Complete removal of ganglion. Death on fifth day from shock. Nothing found at *post mortem* except slight ecchymosis of the temporo-sphenoidal lobe.

(2) Bernandi. Woman, aged 61. Death from failure of heart's action just at the conclusion of the operation. At the autopsy the heart was found to be fatty.

(3) G. R. Fowler (*Med. Record of New York*, 1894, p. 745). Severe arterial and venous hæmorrhage during the operation. All three divisions of the nerve dealt with. Death four hours afterwards. Patient aged 45.

(4) G. R. Fowler. Patient aged 50. Severe hæmorrhage during the operation, although the external carotid artery had been tied. Cavity plugged with gauze. Death from septic infection.

(5) A. G. Gerster (*Med. Times*, 1895, p. 518). Operation in two stages, owing to hæmorrhage. Gauze plug used. Death from septic meningitis and cerebritis.

(6) J. T. Finney (*Johns Hopkins Hosp. Bulletin*, 1893, p. 91). Patient aged 69. Complete removal of the ganglion, "its roots being torn from the pons varolii." Death seven hours after the operation. The middle meningeal aperture had been plugged with gauze.



(7) G. R. Fowler (*Medical Record of New York*, 1894, p. 745). Patient aged 45. Very abundant hæmorrhage, arterial and venous. All three divisions were cut. Death (evidently from shock and hæmorrhage) four hours later. This case is specially noteworthy on account of the comparatively early age of the patient.

(8) W. W. Keen (*Amer. Journal of Med. Sci.*, January, 1896). Patient aged 63. Two days after the operation the temperature rose, and within a week the patient died of septic meningitis. The infection was undoubtedly due to one of the assistants, who had put one of the instruments used in his mouth before the operation.

(9) W. W. Keen. Complete removal of the ganglion; the cavernous sinus was freely opened in dealing with the ophthalmic division. The hæmorrhage was arrested by plugging. The patient was found to be hemiplegic after the operation; did not regain consciousness, and died on the third day.

(10) Lange (reported by Keen in Chipault's *Chirurgie Nerveuse*). Patient aged 63. The operation was attended by special difficulty and accidents, the bone-cutting forceps breaking and injuring the brain. The ganglion could not be removed, and the hæmorrhage was severe. After the operation, hemiplegia was noticed *on the same side*, death resulting from œdema of the lungs. No explanation was found *post mortem* for the hemiplegia.

(11) W. Meyer. Patient aged 30. Suppuration in connection with a ligature followed the operation, and death three months later from cerebral abscess.

(12) W. P. Nicholson (reported by Keen, *loc. cit.*). Patient aged 62. Skull very thick; middle meningeal artery buried in it. Formidable hæmorrhage checked by gauze-plugging. Death four days later. No meningitis.

(13) J. Ransohoff (*ibid.*). Patient aged 50. Excessive hæmorrhage. Death from shock.

(14) L. A. Stimson (*ibid.*). All three divisions dealt with. The patient's breathing stopped during the eleva-



tion of the brain; the pulse became very rapid, the breathing again enfeebled, and death ensued in six hours.

(15) L. M. Tiffany (*Annals of Surgery*, March, 1895). Patient aged 71. Paralysis of the opposite arm followed the operation. The wound healed quickly, but had to be reopened at the end of a week in order to remove blood-clot. In the third week septic infection proved fatal.

The main risks of the operation are seen to be three: shock (sometimes caused by injurious pressure on the brain), hæmorrhage, and septic infection; it may be said these three are one. Severe hæmorrhage is generally due to opening the cavernous sinus during the attempt to completely remove the roots of the ganglion and its ophthalmic branch; to check the bleeding the operator resorts to plugging with gauze, which causes injurious pressure on the brain and increases the risk of septic infection.

If the patient be operated upon in the vertical (sitting) posture, as Krause recommends, the bleeding is rarely severe, especially if the interference is limited to the lower two-thirds of the ganglion. In any case plugging with gauze should be avoided; a small drainage-tube should invariably be left in the wound for twenty-four hours, and, of course, the greatest care should be taken to avoid sepsis. It may be noted that the latter ought never to occur, the temporal region being a most favourable one to render aseptic, and wounds made here heal very kindly. The danger of causing injurious pressure by the retractor, during the operation,



should be borne in mind throughout the operation. In one of my cases it was the cause of temporary hemiplegia, and several other examples of it have been recorded. Thus, Krause records one case in which an extravasation of blood occurred into the right cerebral hemisphere, the patient ultimately recovering. Biondi noticed temporary aphasia in one case, and in two others slight auditory defect, due, doubtless, to pressure on the temporo-sphenoidal lobe during the operation, the defect persisting for some six months.

An instance of severe "pressure paralysis" following operation on the Gasserian ganglion is recorded by Dr. Howard D. Collins (*Annals of Surgery*, 1903, vol. xxxviii., p. 665). The hæmorrhage during the operation was severe, and as the osteo-plastic flap method was used, it is possible that an accumulation of blood-clot may have been to blame for the subsequent paralysis; Dr. Collins, however, attributes it solely to the retraction employed during the operation. For days afterwards the patient was drowsy and lethargic; there was partial paralysis of both opposite arm and leg, and complete paralysis of all the oculo-motor muscles on the same side. After some weeks all the paralytic symptoms improved and ultimately cleared off, though the patient's memory was said to be permanently affected.



*Oculo-motor Complications following the Operation.*

These occur almost solely when the whole ganglion, including the ophthalmic division, has been removed; they vary much in degree, and may be either temporary or permanent. In some cases merely ptosis or impaired movement of the globe in one or other direction results; in others the paralysis may be for a time complete. Of the latter Mugnai records an example. At the end of three weeks, movements of the eye were regained, but ptosis persisted. Other instances of temporary paralysis are recorded by G. Andrews<sup>1</sup> (two cases out of five operated on by him), by F. Hartley,<sup>2</sup> and others. In a case recorded by Davis<sup>3</sup> "the third and fourth nerves were paralysed for a time, and the sixth nerve was probably destroyed." As, however, the affected eye had to be excised later, owing to keratitis, the oculo-motor paralysis did not matter very much. Lexer observed paralysis of one or other oculo-motor nerves in four out of twelve cases operated on by himself; in three, the paralysis passed off, but in the fourth case paralysis of the sixth nerve persisted.

Professor Krause noted temporary paralysis of ocular muscles in five out of twenty-five of his cases.

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<sup>1</sup> Andrews, quoted by Keen in Chipault's *Chirurgie Nerveuse*, vol. iii., p. 691.

<sup>2</sup> Hartley, *Annals of Surgery*, 1893, I., p. 512.

<sup>3</sup> Davis, *Univ. Pennsylvania Med. Bull.*, 1904, No. 2.



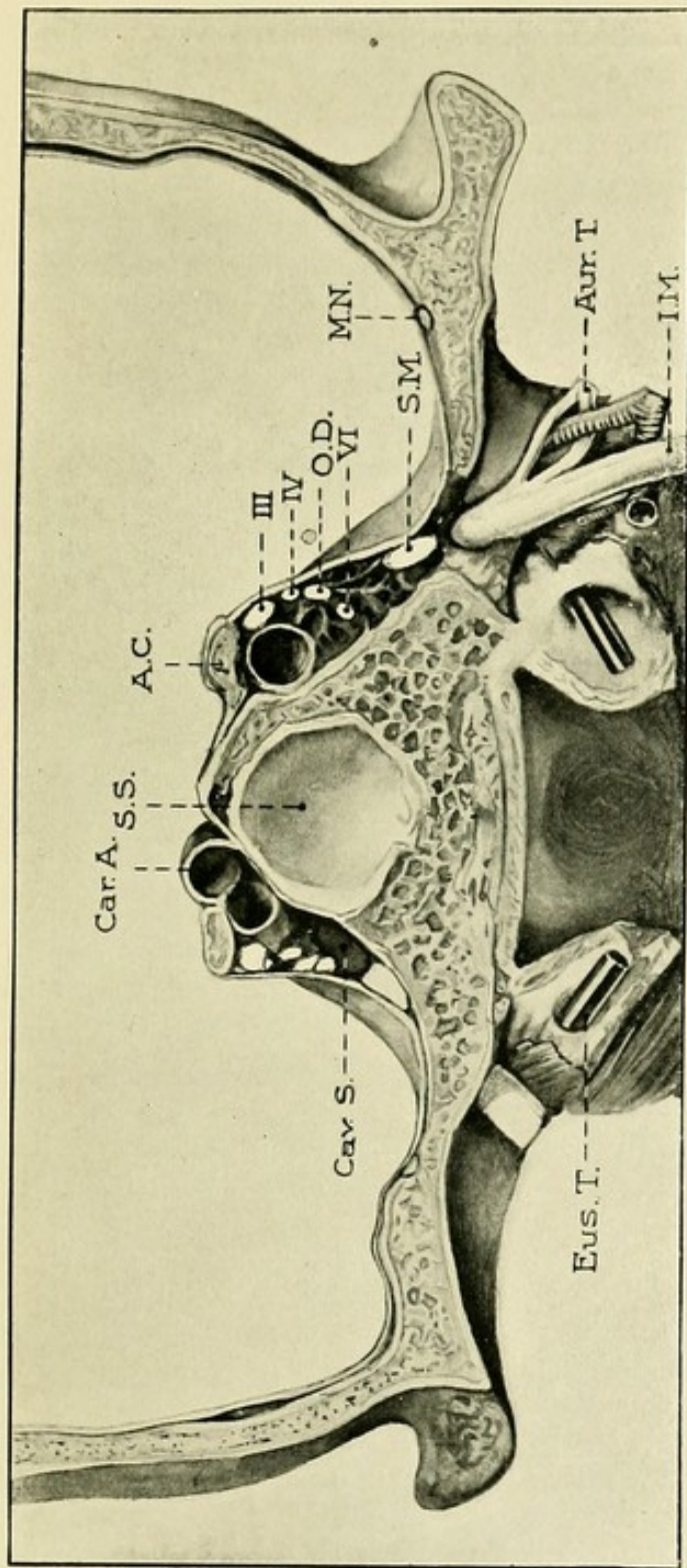


FIG. 21.

Transverse, vertical section in front of the Gasserian ganglion to show the relation of the three divisions of the fifth nerve and their relation to the cavernous sinus. (From a dissection in the London Hospital Museum.) S.S.—The posterior wall of the cavernous sinus. Car.A.—Carotid artery. A.C.—Anterior clinoid process. Cav.S.—Cavernous sinus. Eus.T.—Eustachian tube with a glass rod inserted on each side. M.N.—Anterior branch of middle, meningeal artery lying in the dura mater lining the middle fossa. III.—Third nerve. IV. and VI.—Fourth and sixth nerves. O.D.—Ophthalmic division of the fifth nerve (drawn rather too small). S.M.—Superior, and I.M., inferior, maxillary divisions of the fifth nerve. Aur.T.—Roots of auriculo-temporal nerve, enclosing the middle, meningeal artery.







It is obvious that this complication is a frequent one, if, in the hands of so experienced an operator as Krause, it occurs in 20 per cent. ; but it may be avoided with almost complete certainty, provided that the ophthalmic division is spared. The close relation of the latter to the fourth and sixth nerves in the wall of cavernous sinus is well shown in fig. 21.

*Laceration of the Dura Mater.*—This has often occurred during the operation : indeed, during the last stage, when the thin covering of the ganglion itself is being reflected, it can hardly be avoided in many cases. The cerebro-spinal fluid escapes and, for a time, may hinder the completion of the operation, but, provided asepsis is secured, no other harm will result. During the early separation of the dura from the temporal fossa, every care should be taken not to perforate the membrane, which, however, varies greatly in toughness and degree of adhesion to the bone. Occasionally, it tears at the slightest touch, but in other subjects it is firm and readily detached.

*Laceration of the Wall of the Cavernous Sinus.*—This happened in two of Krause's twenty-five cases ; in both, the severe hæmorrhage was ultimately stopped by compression (plugging with sponge). Several other instances have been recorded, and it is noteworthy that, where plugging with gauze has been necessary, death has resulted from sloughing of dura mater or septic infection in many cases.



Wound of the cavernous sinus is a most serious complication for this reason, and also, because it renders the proper completion of the operation impossible.

In concluding this review of the various accidents that may occur during and after excision of the Gasserian ganglion, I may point out that, provided the modified form of the operation be carried out, (removal of the superior and inferior maxillary trunks, with the greater part of the ganglion, but sparing the ophthalmic division), the risks are diminished in the following respects :—First, there is no anæsthesia of the cornea, and, hence, no risk of loss of the eye. Second, there should be no danger of injuring the oculo-motor nerves, nor of wounding the cavernous sinus. Third, the severity of the operation is rendered less, the degree of hæmorrhage, and the chance of injurious pressure on the brain being both materially diminished.

Those who advocate the complete removal of all three divisions of the nerve with high section of the roots will, no doubt, reply that by leaving the ophthalmic trunk recurrence of the neuralgia will take place in it. They may fairly be asked to prove that this has ever occurred.

It must be admitted that, in certain cases, operation on the Gasserian ganglion, whatever form it takes, is to some extent a failure.

There is, of course, no reason why neuralgia should not recur on the opposite side of the head,



and were arterio-sclerosis one of the causes (as asserted by Keen), one would expect this to occur fairly frequently ; but nothing is more characteristic of epileptiform neuralgia than its unilateral nature, even if it exists many years. Amongst the records of several hundred cases, I have been able to find only two or three, in which recurrence on the opposite side has followed operation. R. Winslow,<sup>1</sup> in 1895, removed partially (by curetting) one Gasserian ganglion. The patient suffered subsequently from diplopia, mental defect, and aphasia ; all these symptoms cleared off. In 1896 she "complained of neuralgia on the other side of the head." In no case yet recorded has the neuralgia on the opposite side approached in intensity the original trouble.

Lexer, out of ten cases, observed recurrence of the neuralgia on the same side in one, and on the opposite side of the head in another case. Salomoni (*Clinica Chirurgica*, Feb. 1893), after operation on the Gasserian ganglion on one side, records that neuralgia recurred on the opposite one some two months later. The ultimate result is not stated.

I have had the misfortune to encounter one of these cases in which recurrence of a certain kind (chiefly limited to the other side of the head and face) has followed excision of the Gasserian ganglion.

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<sup>1</sup> *Maryland Med. Journal*, May 2, 1896.



The notes are as follows :—

Ellen P., a stout, and previously healthy woman, began to suffer at the age of 37 from neuralgia on the right side of the lower jaw. With the idea of relieving this, the teeth were removed, whether decayed or not, from first the lower, and then the upper jaw, as far forwards as the canine. No relief whatever followed this procedure. From the first, the pain was of the spasmodic, intermittent type, the intervals (at first a few months) becoming shorter, until, at the end of five years, she was hardly ever free from pain. When she came under surgical treatment, being sent to me by Dr. F. M. Mackenzie, she had endured the neuralgia for six years, and her health was much lowered in consequence. Medicines had but little or no effect in relieving her.

The pain was most intense in three positions :—(1) over the lower jaw ; (2) in the cheek, and (3) in the temple. From these areas the spasmodic pain radiated upwards towards the right eye, which constantly watered, and towards the vertex. In addition, the right side of the neck was painful, and the whole right side of the scalp was so tender that she could not bear to comb her hair. Mastication was accompanied by pain, so that she took only soft or fluid food with difficulty. The alveolar surface on the affected side was extremely tender, and the act of removing her tooth-plate, or merely talking, invariably brought on an acute spasm.

It will be noted that in this case the neuralgia involved, primarily, the inferior maxillary division, but had spread to the superior maxillary one, whilst areas supplied not by the fifth nerve, but by the cervical nerves, were painful and tender.

As in many other examples, operation on the Gasserian ganglion was successful in removing the referred as well as the direct pain. Operation on February 25, 1903, after preliminary shaving of the right side of the scalp and disinfection of the skin. The patient was throughout



in the upright position in a dentist's chair. No trouble was met with as regards hæmorrhage or exposure of the ganglion. The middle meningeal artery was left undivided. The lower half of the ganglion and both superior and inferior maxillary divisions were removed, the ophthalmic trunk being deliberately spared. The bone was not replaced, a small spiral drain being inserted for twenty-four hours. The wound healed by first intention.

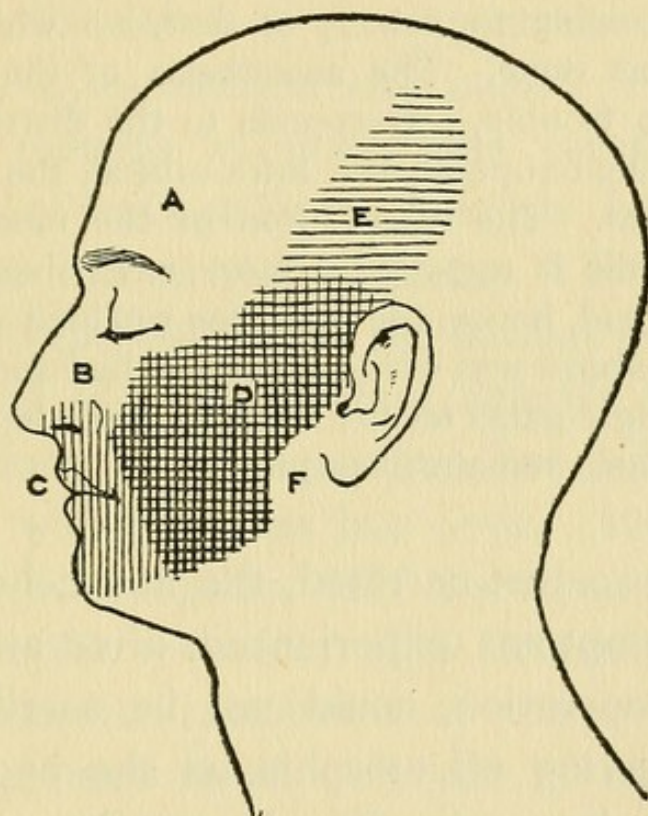


FIG. 22.—Anæsthetic area left after removal of lower part of Gasserian ganglion. A, ophthalmic nerve area (intact). B, side of nose (sensation retained). C, lips (sensation largely lost). D, complete anæsthesia. E, sensation impaired in temple. F, masseteric region (sensation retained).

When she left the hospital on March 20th she complained of headache, and, later on, the left side of the face and head became subject to stabbing pain. She could, however, sleep well (before the operation her nights were a misery to her) and took food with enjoyment. I saw her from time to time and was anxious lest the neuralgia should develop severely on the left side. A second operation and removal of the other Gasserian ganglion was not



to be contemplated without much hesitation, owing to the complete paralysis of masticating muscles that would ensue. Fortunately, under the administration of tonics, chiefly *nux vomica*, with the occasional use of phenacetin, the threatening symptoms passed off. At the end of ten months from the operation she was in excellent health, and free from pain—was, in fact, “another woman.” The bony aperture has filled up so that no pulsation can be detected; the scar is well hidden by the hair, and it is almost impossible to detect, at first, on which side the operation was done. The anæsthesia of the face, which gives her no trouble, corresponds to the distribution area of the auriculo-temporal, the infra-orbital, the buccal, and mental nerves. The distribution of the nasal branch of the ophthalmic is apparently more extensive than usual in this case, and, hence, the nose has retained sensation.

Since the above was written, she has had some return of vague neuralgic pains on the left side, and the final ending of the case must remain uncertain.

In the case just narrated, the headache and other nervous symptoms experienced, after an otherwise successful operation, could not be ascribed to the patient's leaving off morphia, as she had not been addicted to it previously. In another case of my own, in which enormous doses of morphia had been resorted to hypodermically, in order to get some respite from the pain—the arms were scarred all over from the punctures—it seemed doubtful whether the patient would be able to discontinue the drug suddenly; but not a single dose was given after the operation, and the patient's mental condition was quite normal. It may, however, be advisable in some cases to rapidly diminish the



dose and, perhaps, to substitute injections of distilled water; or sedatives, other than morphia, may be tried. In one case recorded by W. Keen,<sup>1</sup> the sudden interruption of morphia, after the operation on the ganglion, "produced profound, mental depression; after bromides, strychnine, and chloral had been tried without success, the administration of codeine, in doses of three-quarters of a grain, calmed the hallucinations and pain."

It only remains to notice the cases in which recurrence of epileptiform neuralgia has followed *on the same side* as the operation. These can be put into two classes; either the patient was neurotic or hysterical (*i.e.*, not really a suitable subject for the operation), or the operation has failed to deal adequately with (perhaps has never even touched) the Gasserian ganglion. Of the former there are a few examples recorded. For instance, Professor Krause observed recurrence of the neuralgia on the side operated on in only one of his thirty-six cases (reported 1903). This case was a neurasthenic medical man, in whom peripheral operations had been fruitless. Removal of the Gasserian ganglion, which Krause was led to perform against his will, had no better result, the cause of the neuralgia evidently being cerebral.

Of the second class, that in which a wholly inadequate operation has been done and the

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<sup>1</sup> Keen, *Trans. Philadelphia Med. Soc.*, 1894.



neuralgia has returned, many more instances could be quoted; indeed, it is surprising how many have been published. I once had the opportunity of proving that in a supposed excision of the Gasserian ganglion, performed by one of the best operators in London, the ganglion had never been reached. The patient was a man aged 50, the subject of terribly severe neuralgia. He underwent the operation by the pterygoid route; it was performed in two stages and was an extremely protracted affair, owing to hæmorrhage, &c. A short respite from pain followed, and it was fully believed that the ganglion had been dealt with. However, the very limited anæsthesia that followed might well have been due to the division of cutaneous nerves in the extensive skin incisions. The patient's neuralgia returned worse than ever. He took to injecting morphia hypodermically in almost incredible amounts, and became, physically and morally, a complete wreck.

After his disappointing experience, it was naturally difficult to induce him again to undergo surgical interference, and I expected that the operation would prove unusually difficult, owing to the previous division of the bone round the foramen ovale, &c. This, however, did not prove to be the case. The middle fossa had been perforated about half an inch to the outer side of the foramen ovale, and the ganglion, with its branches, was quite intact. Nothing could be a stronger commentary



on the difficulty of really dealing with the ganglion from below (by the pterygoid route). The only trouble I experienced in this operation was due to hæmorrhage, chiefly from the meningeal artery. The attempt to stop this bleeding, by plugging the foramen spinosum with wax or a spicule of bone, failed, and I therefore tied the external carotid in the neck. The two maxillary nerves were then divided and the ganglion excised.

As an instance of the slight nature of the shock following this operation, this patient was sitting up and writing a letter within twenty-four hours of it. Although he had got used to injecting eight or ten grains of morphia per diem, he was fortunately resolute enough to discontinue the practice entirely as soon as he found the neuralgia had left him. He wrote six months after the operation: "From being a hopeless invalid, I have become as strong and well as at any time during my life, with practically no pain. I have never touched morphia since the operation and have not felt the least desire for it."

It is now (1904) six years since the second operation, and the patient is in good health and free from any recurrence.

I have heard of some other cases in which, after operation by Rose's method (the pterygoid route), the neuralgia was supposed to have been cured, although, subsequently, recurrence in a severe form developed. The explanation is, that the ganglion



was never properly dealt with, owing to the difficulties due to hæmorrhage and insufficient exposure. The same criticism applies to some cases operated on by the temporal route. The sharp spoon is an instrument which has been used by several operators, who appear to think that the ganglion is readily destroyed by a little indiscriminate scraping in the region of the cavernous sinus. The instrument is unsuitable and dangerous, and should never be employed in this particular operation. Failure is only to be expected if the surgeon relies on this blind groping in the dark, instead of a clean dissection of the ganglion. Equally hazardous and uncertain is the attempt to twist and drag away the ganglion as soon as one of the main divisions is exposed.

It is a curious fact that the extensive surgical interference involved in trephining the skull, with its attendant loss of blood, may cause the neuralgia to cease for days, weeks, or even months, although the ganglion and its main branches have been hardly interfered with at all. The real test of success is complete anæsthesia in the districts normally supplied by the divisions of the fifth nerve concerned. Unless this anæsthesia be clearly made out after the operation, recurrence is almost certain in the future. Now and then the operator has described division of the roots, whilst sensation was perfectly retained in the skin, which is normally supplied by their branches (*e.g.*, in a case recorded by W. Keen,



though not operated on by him, Chipault, vol. iii., p. 694). There must obviously be a mistake on the part of the operator in such cases. Gerster records a case<sup>1</sup> in which, after "destruction of the ganglion," sensation recurred within a month, in both second and third divisions.

In a case published by M. Lardy (Chipault's *Chirurgie Nerveuse*, vol. ii.), the Gasserian ganglion was supposed to have been extirpated, yet sensation was perfect in the whole area supplied by the fifth nerve. The patient was a woman, and the neuralgia "was entirely cured." It is easy for the operator to persuade himself that a little piece of dura mater represents the ganglion. It is impossible to believe, for a moment, that removal of the Gasserian ganglion can be attended by no anæsthesia in the skin of the face.

The difficulties and drawbacks of the operation have been fully discussed, since it was only fair to do so. But, in conclusion, it may be pointed out that few procedures in the whole range of surgery are so successful as excision of the ganglion for true epileptiform neuralgia. With the improved methods of operating and the proper selection of cases, the risk to life is very small, and the prospect of permanent cure is great.

By limiting the excision, and sparing the ophthalmic division, whenever possible, the risk to the eye is done away with.

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<sup>1</sup> *Annals of Surgery*, Jan., 1896, p. 58.



The deformity which results is hardly worth the name; it simply amounts to atrophy of the corresponding temporal muscles. The introduction of the Hartley-Krause method forms one of the most important surgical gains of the last twenty-five years, fertile as that period has been in the progress of surgery.



## REFERENCE TO PUBLISHED PAPERS ON THE SURGICAL TREATMENT OF TRIGEMINAL NEURALGIA.

TIFFANY, (L. McL.) Intracranial operations for the cure of facial neuralgia. "Annals of Surgery," 1896, xxiv. 575 to 736. Details are given of 108 cases, collected from various sources.

*Sex and Age.*—Patients varied in age from 20 years to 79, few being younger than middle life; males were very slightly in excess.

*Operation.*—Two-thirds subjected to the Hartley-Krause operation, *nearly one fourth* to that of Rose, the remainder to other methods. There were forty-seven operators, twenty-five of them operating once each.

*Results.*—Twenty-four deaths, causes of death as follows:—shock 8, sepsis 8, brain trauma 3, brain abscess (from trauma?) 1, apoplexy 1, cause uncertain 3 cases.

BIAGI, L. (*Il Policlinico*, November, 1901). Opposes resection of the Gasserian ganglion on account of its dangers, and advocates dragging away the main branches of the fifth nerve instead. He narrates three cases in which the latter proceeding was carried out "with good result."

FEHLEISEN, F., AND WESTERFELD ("Report of the Surg. Department of the German Hospital, San Francisco, 1901.") They narrate one case in which, after removal of the Gasserian ganglion, sensation returned in the peripheral distribution of the fifth nerve, although at the *post-mortem*, removal "was found to have been complete." No explanation is suggested, and probably a very simple one would suffice.

KRAUSE, FEDOR ("Verhandlungen der Deutschen Gesellschaft für Chirurgie 30 Kongress," 1901). An important account of his experience up to that date, twenty-five cases of "typical extirpation of the Gasserian ganglion." The report is quoted frequently in this book.



- KRAUSE, FEDOR, "Die Neuralgie des Trigeminus, nebst der Anatomie und Physiologie des Nerven," Leipzig, 1896, pp. 260, with two photographs and 50 illustrations in the text.
- LAGUAITE (*Lyon Medicale*, 1896, Tome 83, p. 375). Ligature of external carotid, Poirier's method followed, whole of ganglion removed. Neuralgia was cured, but the eye was lost.
- KEEN W. W. AND SPILLER W. G. (*Amer. Journ. Med. Sciences*, 1898, vol. cxvi. p. 503). Four cases reported, two fatal from injury to brain and hæmorrhage during operation. In one other the eye became ulcerated.
- WEEKS, S. H. (*Trans. Amer. Surg. Assoc.*, 1897, vol. xv. p. 171). Interesting case reported. Meningeal artery torn in turning down flap of bone.
- ABBE, "Annals of Surgery," 1896, vol. xxiii. p. 60). Two cases recorded.
- KEEN, W. W. (*Amer. Journ. of Med. Sciences*, 1896, vol. cxi. p. 68). Five cases recorded, in each a flap of bone was turned down, and in every one profuse hæmorrhage from meningeal arteries resulted therefrom. One case died from septic meningitis, the others did well. In one case the patient had sustained eight previous operations for the neuralgia, in another no less than thirteen.
- GERSTER, A. G. "Annals of Surgery," 1896, vol. xxiii. p. 58. One case reported.
- GERARD-MARCHANT (*Bull. de la Soc. de Chir.*, 1898, vol. xxiv. p. 884). Three cases: all recovered. In one the eye was subsequently lost by trophic ulceration.
- DEPAGE, A. (*Bull. Acad. de Med. de Belge*, 1898, 4th series, p. 294). One case, severe meningeal hæmorrhage, recovery.
- DEPAGE (*Ibid.* 1897, p. 687). A second case, in which the eye was subsequently lost.
- HUTCHINSON, J., Jr. (*Brit. Med. Journ.* Nov. 5th, 1898). Report of case and discussion of the operation.
- HUTCHINSON (*Med. Society's Transactions*, 1900, pp. 274-282). Report of several cases, &c.
- THOMAS, J. L. (*Brit. Med. Journ.*, 1899, vol. ii. p. 1080). Two cases reported of excision of Gasserian ganglion: in both hæmorrhage was severe; in one, operation could not be completed on this account.



- THOMAS, J. L. (*Brit. Med. Journ.*, 1898, vol. i. p. 487). One case, operation not completed owing to severe hæmorrhage.
- MACLAURIN, C. (*Australian Med. Gaz.*, 1901, vol. xx. p. 36). Report of one case in which extra-cranial operations and trephining had previously failed.
- MEYER, W. "Annals of Surgery," 1896, vol. xxiii. p. 61. Interesting case of sudden death from temporo-sphenoidal abscess, one month after operation on the Gasserian ganglion.
- MUGNAI A. ("Il Policlinico, 1897, p. 877.") One case reported.
- CRAWFORD RENTON, J. (*Brit. Med. Jour.* 1900, vol. ii. p. 1435). One successful case.
- RENTON (*Brit. Med. Jour.* November 18th, 1904). Note on case in which neuralgia had been mainly frontal, and in which extensive removal of supra-orbital nerve failed to relieve.
- SCHWARTZ, (*Bull. et Mém. Soc. de Chir.*, 1898, vol. xxiv. p. 857.) Case reported with very bad result (loss of eye &c.), after use of Doyen's method.
- SPELLISSY, J. M. "Annals of Surgery," 1900, vol. xxxi. p. 463. Case reported in which external carotid artery was tied during the operation. Result good.
- GRIESHAMMER, (*Münchener Med. Wochenschrift*, 1901, No. 20).
- SCHWAB, SYDNEY J. ("The pathology of trigeminal neuralgia, illustrated by the microscopic examination of two Gasserian ganglia." "Annals of Surgery," June, 1901.
- SIR VICTOR HORSLEY (*The Clinical Journal*, 1897, vol. xi. pp. 8 to 14, and 17 to 23). (Two lectures, giving a full account of the operation of complete excision of the Gasserian ganglion based on eight personal cases).
- DAVIS (*Univ. of Pennsylvania Med. Bulletin*, No. 2, 1904). Discussion of the various modern methods of operating for trigeminal neuralgia.
- COELHO (*Révue de Chir.* 1897, vol. xix. p. 623). Case of operation in two stages. The cornea became opaque but ultimately cleared.
- BLAND-SUTTON, J. (*Med. Press*, 1898, vol. i. p. 549). Successful case.
- GUÉNARD, A. (*Bull. de la Soc. de Chir.* 1898, vol. xxiv. p. 840). One case, not very clearly reported.
- JABOULAY (*Lyon Médicale*, 1901, vol. xcvii. p. 192). Operation by Poirier's method with resection of the zygoma.



The following papers are less important, or inaccessible to the author.

- BARCLAY, W. M. Surgical treatment of Tic Douloureux, removal of the Gasserian ganglion. *Bristol Med. Chir. Jour.* 1896, xiv. 55). [This paper gives a tabulated list of thirty-seven cases, operations, results, &c.]
- CAMINETI, R. Recherches sur l'anatomie chirurgicale du ganglion de Gasser ("Trav. de neur. Chir." (Chipault), 1900, v. 323). [No cases].
- CARSON, N. B. The surgical treatment of trifacial neuralgia, with report of a case of removal of Gasserian ganglion. (*Med. Rev. St. Louis*, 1899, xxxix. 199, 219).
- CHIPAULT. Resection du ganglion de Gasser. (*Rév. de Chirurgie*, 1900, xxii. 393. [No cases].
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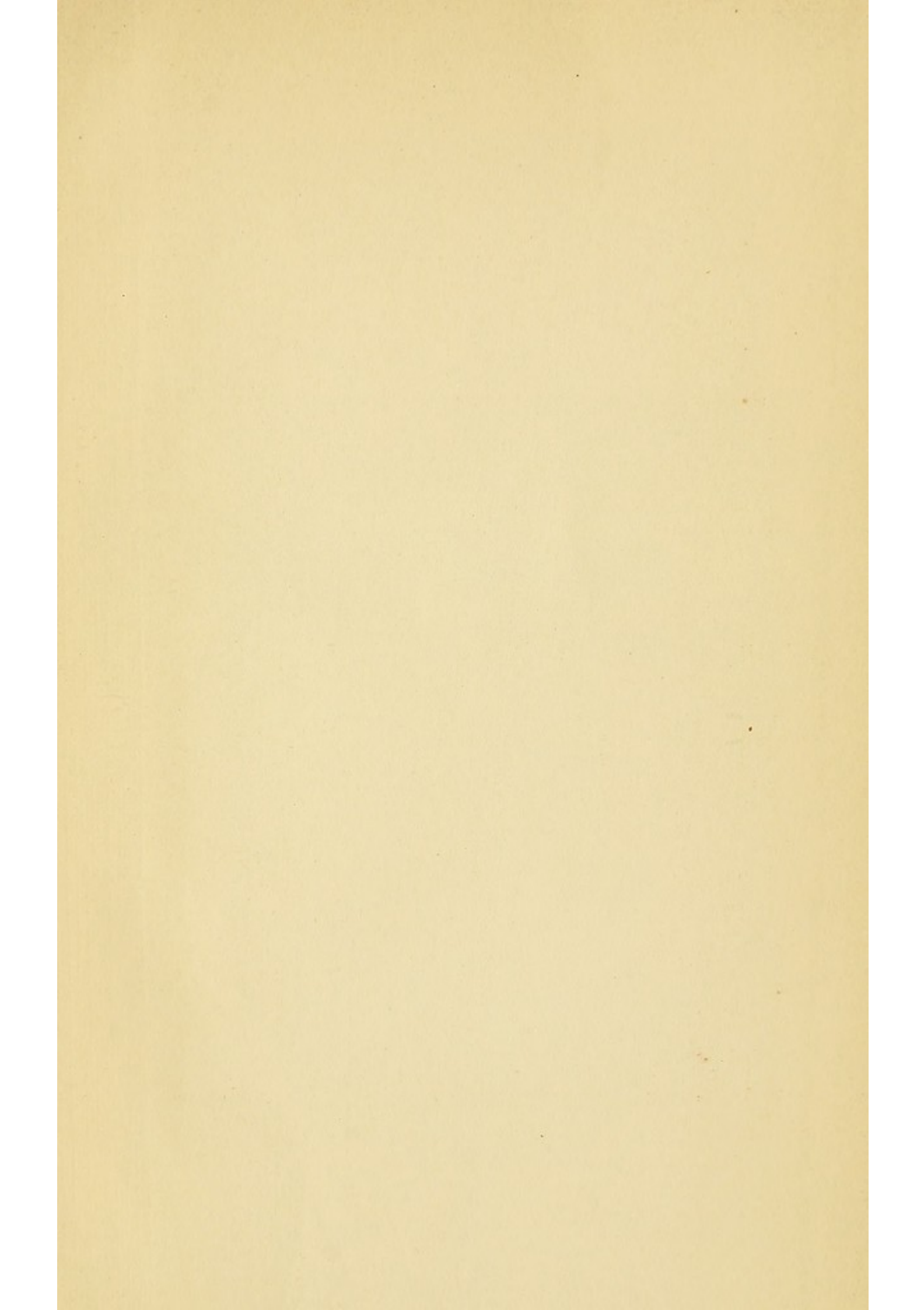
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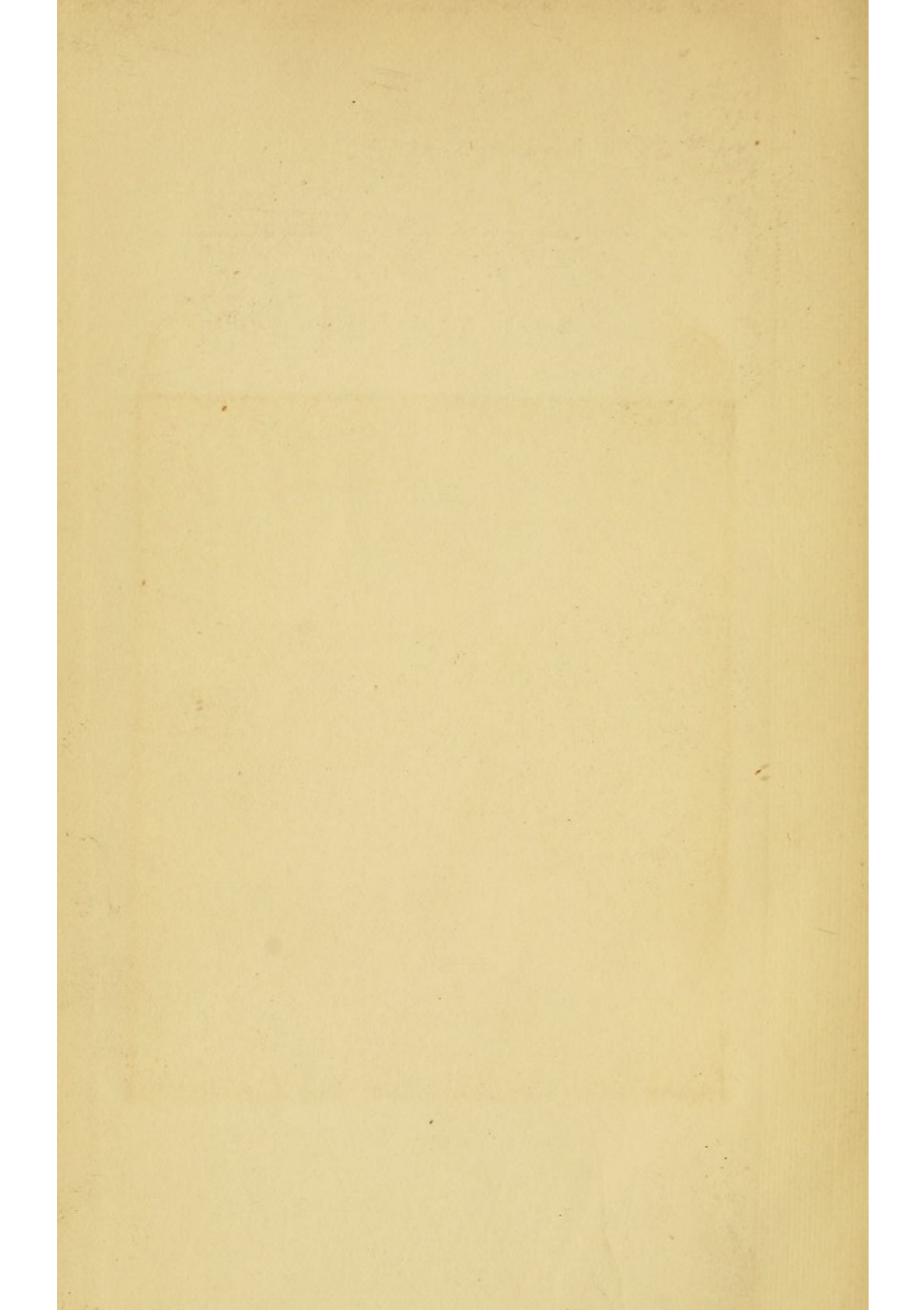
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