

as quickly as possible, and thus avoid the dangers of a long time in the horizontal position, which often causes hypostatic pneumonia in the aged. My patient was a very vigorous woman and has made a perfect recovery. The callus in each case was large and securely held the fragments in proper apposition and subsequently made good bone.

## OSMIC ACID INJECTIONS FOR RELIEF OF TRIFACIAL NEURALGIA.

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(Concluded from page 955.)

### CLINICAL CASES.

**CASE 1.**—Mr. A. L. C., age 76 years, retired farmer. Admitted to Mercy Hospital June 8, 1903.

**Present Illness.**—For thirteen years has suffered from neuralgic pains in right side of face, but they were not very severe or constant until four years ago. At that time he had a severe attack which he thought was caused by a diseased right upper cuspid. The tooth was removed about two months after the onset, and for six weeks following he was relieved. Pain then recurred and was severe and persistent. Two years ago he had an operation performed on the right superior maxilla, the exact nature of which he does not know. He was free from pain for four months after the operation, but at the end of that time it returned and has been present, at intervals, ever since. The pain is of a severe shooting character, beginning at right ala nasi and radiating toward cheek. He also has some pain in the forehead, just above the right eyebrow, radiating toward temple. General health has been fair for a man of his years.

**Previous History.**—"Ague," "bilious fever," etc., years ago. Used to smoke and drink moderately. Family history negative. Examination shows a man of rather poor nourishment; lungs and heart negative; arteries sclerotic. Urinalysis negative. Slight tenderness over supra- and infraorbital divisions of fifth nerve at their foramina of exit. No areas of hyperesthesia or anesthesia and no evidences of tumor or inflammatory processes along the course of either nerve.

**Operation.**—June 11, 1903. Supraorbital, infraorbital and mental branches injected with  $1\frac{1}{2}$  per cent. solution of osmic acid. In the afternoon his temperature was 99.8 F., and pulse 64. His pain had entirely disappeared. June 12, p. m., temperature 100, pulse 70; June 13, p. m., temperature 99.8, pulse 62; June 14, temperature and pulse normal; sat up in chair. After this temperature remained normal, he was up and around every day and the sutures were removed June 17. Wounds healed by primary union. Patient discharged from hospital, with pain entirely gone, June 20. In a report received from this patient July 21, he states that there has been no recurrence of the pain and that he feels perfectly well.

In a later report received April 14, 1904, he says he has had no pain since operation and that his general health is excellent. Appetite good, and he sleeps well.

**CASE 2.**—Mr. H. H. C. Age 55 years. Farmer. Admitted to Mercy Hospital Sept. 25, 1903. Family history negative.

**Previous History.**—"Typhoid fever" at 35. "Measles" 12 years ago. "Catarrh" for the past 30 years. Had recurring attacks of "malaria" 25 years ago. Attacks were always cured by quinin. Never used alcohol to excess, but has chewed tobacco.

**Present Illness.**—Twelve years ago while working in the cold suddenly felt sharp pain in right lower jaw and a little later in right upper jaw also. This attack was of short duration, but in the year following he had a second similar one. Since then they have recurred at gradually shortening intervals, and have become more severe and the area involved more extensive. For some time past the entire right side of the face and nose have been affected and the pain has been almost constantly present. It is always aggravated by eating and talking. He has had frequent acute exacerbations of the pain during

which it is sharp and shooting in character and radiates from the malar prominence to the lower jaw, above the right eye and over the right side of the nose and temporal region.

**Examination.**—Shows a well-nourished man of medium stature. The foramina of exit of the three branches of the fifth nerve on the right side are tender to pressure. Urinalysis negative.

**Operation.**—Sept. 27, 1903. Supraorbital, infraorbital and mental branches injected with  $1\frac{1}{2}$  per cent. solution of osmic acid. Convalescence was uninterrupted and the wounds healed by primary union. (Sutures removed October 3.) On September 28 patient complained of slight twitching pain in the two upper wounds when he was eating breakfast. October 1, examination showed no sensitiveness to the prick of a pin over the area supplied by the supraorbital. Analgesia also present in area anterior to mental foramen. Has had no pain in the upper lip. There is sensitiveness, however, posterior to the outer canthus of the right eye and this area extends down on the side of the face. On the night of October 3 he had an attack of pain in the right side of the face above. This was similar to, but not so severe as the pain from which he suffered before the operation. October 6, patient stated that the pain was rapidly diminishing in intensity and that he had had no pain in the lower jaw. Left hospital Oct. 8, 1903.

Patient readmitted to hospital April 7, 1904. For three months after going home he had very little pain, but in January, 1904, the pain returned in the right lower jaw behind the molar teeth and extending backward and upward to a point in front of the auditory meatus. It was not so severe as formerly, but came on every day un'til two weeks ago, when it subsided. About March 1 he began to have pain in the right upper jaw, extending along the gum and roof of the mouth. This was very severe and has continued almost constantly until the present time. He had no pain around the eye nor on the forehead, but slight in the right ala nasi.

Examination of the patient shows: 1. A zone of diminished sensibility 1 inch in width by 3 inches in length, extending above the right eyebrow. 2. Diminished sensibility of right side of nose. 3. Area of diminished sensibility on chin extending from symphysis to right angle of mouth and from lip to edge of jaw. There are no areas of complete anesthesia.

**Second Operation.**—April 9, 1904. The infraorbital nerve was exposed by incision through the mouth and injected thoroughly with a  $1\frac{1}{2}$  per cent. solution osmic acid. The mental branch was then similarly treated. The inferior dental branch was next exposed as it entered the mandibular canal and also injected. The lingual nerve was isolated just posterior to the last molar tooth and injected. Lastly, the posterior palatine nerve was injected, and the posterior palatine foramen. In the nerves which had been previously injected was found the staining of the tissue by the osmic acid, but there was no destruction of the nerve substance. Convalescence uninterrupted and the patient left the hospital April 16, 1904. At the time of his discharge he had absolutely no pain and had had none since operation. The right half of the tongue, right half of lower lip and of face, external to nose, were anesthetic and analgesic. Letter received from this patient since his return home states that he has remained entirely free from pain.

**CASE 3.**—Mrs. W. B. Age 28 years. Admitted to Mercy Hospital Oct. 6, 1903.

**Family History.**—Brother and sister died of pulmonary tuberculosis.

**Previous History.**—No serious illness. Had two miscarriages, but no children at term.

**Present Illness.**—Fourteen years ago began to have severe neuralgic pain around the right eye. Since then the attacks of pain have become more frequent and severe and for the last eight years she has been confined to bed every two weeks with the very severe pain about the right eye. The attacks usually last 24 to 36 hours. No pain in any other part of the head or face. Examination shows no tenderness over the supra- or infraorbital nerves. Urinalysis negative, except for the presence of a few pus cells.

**Operation.**—Oct. 7, 1903. The supraorbital and infraorbital

nerves exposed by external incision over the foramina of exit and injected with a 2 per cent. solution of osmic acid. The mental nerve exposed by incision from within the mouth and injected. Convalescence uninterrupted.

Examination of the patient October 9 showed numbness of the skin over the right side of the face and scalp backward to the occipital protuberance. An area just in front of the right ear was not completely analgesic, but still sensitive to the tests.

Second examination, October 13, showed numbness over right side of face and scalp except in front of the right ear. Patient left the hospital Oct. 13, 1903.

In a report received April 14, 1904, she states there has been a return of pain just above the right eye. A few attacks have been nearly as severe as before operation, but most of them have been slight and have not lasted so long. She also states there is no numbness now present in the face. General health good. The attacks of pain always come on when she is tired out or nervous.

CASE 4.—Dr. E. R. M. Age 40 (?) years. Admitted to Mercy Hospital Sept. 11, 1903.

*Present Illness.*—Seven years ago patient sustained a crushing injury of left hand necessitating amputation through forearm about one inch above the wrist. Immediately after operation patient complained of severe pain in the amputated hand and this persisted until March, 1897, when a second amputation was done a short distance above the first. This gave him no relief, so a month later, a third amputation, with resection of the ulnar and median nerves, 2 inches above the elbow, was performed. As the pain continued severe after this, a fourth operation was performed in November, 1898, wedge-shaped piece being removed from the ends of the nerves and the edges of the resulting defect, with the sheath, sutured together. The "pain in the hand" still persisted and in August, 1901, the radial, ulnar and musculospiral nerves were again resected, but with no benefit to the patient.

*Operation.*—Sept. 12, 1903. Incision in left axilla, along border of pectoralis major. Brachial plexus exposed and its inner, outer and posterior cords thoroughly injected with a fresh 1 per cent. solution of osmic acid. Wound healed by primary union. Immediately after this operation, the pain was somewhat less severe than before, but the improvement did not last long. He left the hospital September 25. From then until October 9 the pain was about the same as before the injection. He was readmitted October 9 and again operated on October 10. This time the pectoralis major was divided square across and the brachial plexus exposed at its upper part. The 3 trunks were again isolated separately, and each injected for  $\frac{3}{4}$  inch with a 2 per cent. solution of osmic acid. The infiltration of the nerve substance was very thorough and 20 to 30 m. of the solution were used in each trunk. The ends of the pectoralis were then approximated with heavy catgut sutures and the skin brought together by means of silkworm gut and horsehair. Convalescence was uninterrupted. On October 15 the sharp pain which had been present in the fingers had disappeared, but he occasionally had very severe pain in the hand. On October 17, pain in fingers had returned, but there was no "transmission of pain upward along the nerves" when he moved or exerted pressure on them as there was before operation. There was complete anesthesia and motor paralysis of parts supplied by the injected nerves. He could not flex and extend elbow, but was able to rotate a shoulder. He left hospital Oct. 23, 1903.

In a report received April 14, 1904, patient states that the pain in hand and fingers is just as severe as before operation. Transmission of pain on pressure or friction upward along nerves in arm is returning. The numbness which was present immediately after operation is gradually disappearing, though it is still present on outer surface of arm and over entire forearm. Motion is gradually returning in muscles of shoulder and upper arm.

CASE 5.—Dr. S. W. L. Age 62 years. Admitted to Mercy Hospital Oct. 31, 1903. Family and previous history negative.

*Present Illness.*—For past eight or nine years patient has suffered at irregular intervals from attacks of severe pain in right side of face. Pain begins at ala of nose and radiates to

right side of nose and upper lip, infra- and supraorbital regions, passing upward  $1\frac{1}{2}$  inches above right eye and backward to a point  $1\frac{1}{2}$  to 2 inches anterior to right ear. The pain is at times most intense and often accompanied by twitching of right facial muscles. Examination shows extreme tenderness on pressure over right supraorbital foramen and along the right side of nose, especially at lower part. Urinalysis, negative.

*Operation.*—November 2. The supraorbital and infraorbital branches were exposed by external incisions, and the mental by incision through mouth at junction between lower lip and outer surface of lower jaw. Each branch was thoroughly injected with a 2 per cent. solution of osmic acid. Convalescence uneventful.

Examination November 3 showed anesthesia of right side of face extending upward 1 inch above supraorbital ridge, backward to a vertical line drawn  $\frac{3}{4}$  inch anterior to right external auditory meatus and inward nearly to median line. The pain had entirely disappeared. He left hospital November 5.

In a report received April 14, 1904, he states there had been no return of the pain. After returning home the infraorbital wound became inflamed and discharged a small quantity of pus for two months. It then healed permanently. The numbness of right side of face was still present.

CASE 6.—Mrs. A. B., age 63 years. Admitted to Mercy Hospital Dec. 1, 1903. Family history, negative.

*Previous History.*—Has been constipated since childhood. Has had three children, all living and well. Had infectious diseases of childhood and "typhoid fever" twenty-nine years ago.

*Present Illness.*—Began eight years ago during the cold weather with marked hypersensitiveness over the right malar prominence, followed in a short time by aching pain in the right upper jaw. The dentist extracted two teeth which were supposed to be the cause of the pain. Then she had some relief for a few days. Pain then returned and was continuous with severe acute exacerbations, usually coming on at night for the two years following. It then gradually gave place to frequent attacks of very severe sharp shooting pain in the right upper jaw. In January, 1900, the lancinating pain began to radiate into the right lower jaw and has persisted in two lower divisions of the fifth nerve since that time. For the last two and a half years she has rarely slept longer than a half hour at a time, because of the intensity of the pain and the frequently recurring attacks. Supraorbital nerve has not been affected; some dull occipital headache since  $2\frac{1}{2}$  years ago. Examination: Marked tenderness over the foramina of exit of the infraorbital and mental nerves. Urinalysis, negative.

*Operation.*—Dec. 12, 1893. Infraorbital nerve was exposed by incision through the mouth at junction between the cheek and the upper jaw, above the cuspid tooth. The mental branch was exposed by incision within the mouth at the junction between the lower lip and the lower jaw. Both were thoroughly injected with a  $1\frac{1}{2}$  per cent. solution of osmic acid. Convalescence uneventful, except that slight purulent discharge persisted from the upper wound. Patient left the hospital December 12 with pain entirely relieved.

In report received from this patient April 14, 1904, she states there has been absolutely no return of the pain. Slight discharge persisted from the upper wound for a month after going home and for a shorter time from the lower wound. Numbness of the parts supplied by the injected nerve persists. Her health, she says, is better than it has been for many years.

CASE 7.—Mr. M. M. J. Age 54 years. Admitted to Mercy Hospital Dec. 8, 1903.

*Family History.*—Father has been a sufferer from trifacial neuralgia for a number of years.

*Previous History.*—Eight years ago patient had renal colic and passed some small calculi and blood in his urine. Last spring complained of painful urination and pain in lumbar region and, at times, along the sciatic nerve.

*Present Illness.*—Began six years ago with hypersensitiveness in left supraorbital region. At that time pressure above the left eye would cause shooting pains through the head. A few months later he suffered an attack of "erysipelas" on the left side of the face and following this had severe shooting and

burning pain, coming on in paroxysms, in left side of face. The pain was most severe in the left side of upper lip, cheek, supra-orbital region, roof of mouth, and in an area just posterior to and in front of the external meatus. The paroxysms have persisted since onset, but have come on at irregular intervals. At one time he was free from pain for a year, but since about nine months ago the attacks have come on every day.

*Examination.*—Shows tenderness on pressure over foramina of exit of the three branches of the fifth nerve on the left side. Urinalysis, negative.

*Operation.*—December 9. Supraorbital nerve exposed through incision over supraorbital foramen. Infraorbital and mental nerves reached through incisions from within the mouth. All three branches thoroughly injected with a 1½ per cent. solution of osmic acid. On December 16 some offensive purulent material was discharged from infraorbital incision. Also slight discharge from the incision over the mental foramen. Primary union of supraorbital wound. Patient left hospital December 22, with pain entirely gone, but some discharge from two lower wounds persisting.

In report received from this patient April 14, 1904, he states there has been no return of pain. Discharge from infraorbital and mental wounds continued for one month after going home. Before the lower wound healed a small piece of necrotic bone in the lower jaw was discharged. The numbness of face, supplied by the injected nerves, continues. His general health is excellent and he has gained 20 pounds in weight since the operation.

CASE 8.—Mrs. W. J. C. Age 40 years. Admitted to Mercy Hospital Feb. 10, 1904. Family and previous history negative.

*Present Illness.*—Began 1½ years ago with dull pain in the right side of the lower jaw. After a short time pain began to radiate into the right cheek and upward toward the right eye. When the pain became more general over the right side of the face it came on in paroxysms, lasting for a few minutes at a time and occurring every day for several months at a time. Last October she was free from paroxysms for three weeks. Four months ago pain became less severe in the jaw and concentrated in the right eye and right supraorbital region. At the same time it developed in the inner side of the right upper jaw and right half of hard palate, where it has persisted until the present time. At times she has had shooting pains in the back of the neck, in front of the right ear, and in the right half of the tongue.

Examination shows tenderness over the supraorbital, infraorbital and mental foramina. Urinalysis: Albumin present; no sugar, no casts. This albuminuria was transient and disappeared after a few days.

*Operation.*—Feb. 11, 1904. Supraorbital nerve injected through incision over supraorbital foramen. Infraorbital and mental nerves exposed through incision within the mouth. All three nerves injected with 2 per cent. solution of osmic acid. The posterior palatine nerve was exposed through incision in hard palate over posterior palatine canal. It also was injected with 2 per cent. osmic acid solution. On February 13 examination showed numbness of skin on the right side of the face and in mucous membrane of right half of hard and soft palate. Pain did not entirely disappear from the eye until February 20, after which date she had absolutely no more pain. She left the hospital Feb. 26, 1904.

Later reports from this patient show she has had no return of the pain since February 20. Slight discharge persisted from infraorbital wound for several weeks after she went home. The sinus, however, completely closed and she had no further trouble from it. July 18, the sinus reopened and caused some pain for a few days preceding the discharge.

CASE 9.—Mr. A. G. D. Age 63 years. Occupation, merchant. Admitted to Mercy Hospital April 11, 1904.

*Family History.*—One sister has suffered from neuralgia.

*Previous History.*—"Intermittent fever" while in army in 1862. Ten years ago he was told that he had "kidney trouble."

*Present Illness.*—Ten years ago he began to have pain in

the right side of the upper lip and soon afterward in the right cheek. The pain next affected the mental division of the fifth on the right side, and lastly the right supraorbital division. For the first two or three years the pain was not very severe, but the paroxysms gradually increased in frequency and intensity until of late they have been almost unbearable. At this time he had a resection of the infraorbital branch through the foramen into the orbital cavity. It gave relief for a few months only. At the present time all three divisions are about equally affected and there is constant and characteristic radiation. The right side of the face is always tender to pressure, and eating is so painful that frequently he takes no nourishment for a day or two at a time. During a paroxysm of pain the tears flow down over the cheek, the right side of the face is flushed and there is twitching of the facial muscles under the eye. The attacks last a quarter to one minute and occur many times a day and often during the night. When he eats, drinks or swallows he has severe pain in the right side of the hard palate and in the right half of the tongue. Examination shows tenderness over entire right side of face, especially over three foramina of exit. Urinalysis negative.

*Operation.*—April 13. Supraorbital nerve exposed through external incision, infraorbital and mental branches through incision from within the mouth. All three divisions injected with a 1½ per cent. solution of osmic acid. The lingual and posterior palatine nerves were then exposed by incisions through the mucous membrane and injected with the same solution. External wound closed with horsehair suture and mucous membrane wounds with catgut. On April 18 it is noted that the patient had no pains since the operation. On April 20 there was considerable swelling of the right side of the face and he had an afternoon temperature of 100.6 degrees. Sutures removed. Temperature went down to normal the next day and remained so during the remainder of his stay in the hospital. On April 25 the following areas of analgesia were found on examination: 1. Right supraorbital region almost to hair line. 2. Right side of nose. 3. Right side of face, adjacent to nose. 4. Right upper lip. 5. Right lower lip and chin. 6. Right side of tongue and roof of mouth. Taste not affected.

Patient left the hospital entirely relieved of pain on April 27.

In a letter received from this patient, May 24, 1904, he states there has been absolutely no return of the pain. The lower wound is still discharging purulent matter and has been incised several times to secure better drainage. There is some swelling over the lower jaw. This is probably due to a necrosis of the mandible around the foramen menti, the result of the injection. While this case was not a typical one for the osmic acid treatment because the infraorbital nerve had been previously resected, the relief is complete up to date. The infraorbital nerve had redeveloped to about its normal size. It seems to me that the redevelopment of the nerve bears a close relation to return of the neuralgia.

CASE 10.—Mr. C. J. Age 81 years. Admitted to Mercy Hospital April 15, 1904.

*Family History.*—Patient's son was operated on for trifacial neuralgia Dec. 9, 1903. (See Case 7.)

*Previous History.*—Several years ago the superior maxillary was resected at the *foramen of exit from the skull*, with temporary relief to patient.

*Present Illness.*—For several years past has suffered from severe paroxysms of pain in right side of face. The pain radiates through all of the branches of the fifth, but is particularly severe in the infraorbital and the anterior auricular branches and in the right side of the lower lip. The fact that the superior maxillary root had been resected so deep made it questionable whether the osmic acid would relieve the patient, but it was deemed advisable to try it. On exposure of the infraorbital foramen the nerve was found to have regenerated to about its normal size, although sensation to pain over that area was perverted, but not absent.

*Operation.*—April 16. Supraorbital nerve exposed by external incision and infraorbital, mental and posterior palatine by incisions from within the mouth. All four branches were injected with a 1½ per cent. solution of osmic acid.

Convalescence uneventful and patient left hospital April 23. On date of discharge from hospital examination showed analgesia to be present in right supra- and infraorbital regions, right side of nose and right halves of upper and lower lip. The patient has had no pain since operation.

Two months after the operation there began to be pronounced pain in the superior maxillary area and in the anterior auricular branch. This increased rapidly in severity until patient presented himself, July 15, when he was suffering severe paroxysms of pain in the upper jaw and in the neighborhood of the ear. It was decided to remove the ganglion.

*Operation.*—Through the Cushing incision the mandibular and superior maxillary branches were readily exposed. They were divided at the foramen and avulsed with the ganglion. There was considerable hemorrhage, but the patient, notwithstanding his age (81 years), withstood the operation very well. Iodoform gauze drain remained for forty-eight hours, after which it was removed. There was an escape of some cerebrospinal fluid.

This was my twelfth gasserian ganglion operation, but I must confess that familiarity with the technic has not made it any more inviting.

The second and third days following the operation the patient was in excellent condition, save a gradually increasing intestinal tympany; the paralytic condition of the bowel continued for many days, and the marasmus increased. There was primary healing of the wound. On the eleventh day his senile marasmus increased and he died August 4, fourteen days after operation. This case shows what a grave matter it is, notwithstanding the fact that the wound made a primary healing, to operate on a patient of his advanced years.

**CASE 11.**—Miss E. Y. S. Age 50. Admitted to Mercy Hospital June 2, 1904.

*Family History.*—Mother and father died along in their eighties. Sisters and brothers all living.

*Personal History.*—Has always lived at home.

*Menstrual History.*—Began at 14. Regular every four weeks. Usually painful for a day or two preceding flow. Flowed about four days. No intermenstrual flows. Menopause four years ago.

*Previous Illness.*—Measles when young. Some mild attacks of rheumatism.

*Present Illness.*—In May, 1902, patient first felt a sharp, cutting pain in her left cheek along the outer canthus of the eye. She thought it was from her teeth and had most of her upper teeth extracted. Following this she had relief for a day or two. She then called a physician and he gave her medicine which relieved the pain for a short time. She went away to the seashore and the pain grew worse and covered a larger area. Pain traveled up over the eye and involved the lower angle of the jaw. Returned home: pain gradually grew worse and patient was forced to go to bed and remained there for five months, during which time she could not take any solid food, nothing but warm liquid diet, as the pain was so intense when she moved her jaws. She went to California and remained there for many months, but received little or no relief. The pain was almost constant with the exception of a few hours each day.

Present area of pain: Over region of masseter muscle; over and to the side of the left eye; along the angle of the lower jaw; nose has never been involved; gums have never been involved; lower portion of left chin and lip. Bowels usually regular. Appetite fair, but the taking of food was so painful that she is much emaciated.

*Operation.*—June 4, 1904. Exposure of supraorbital, infraorbital, mandibular and posterior palatine branches of trifacial nerve. From 7 to 10 minims of a 2 per cent. solution of osmic acid were injected into each of the nerve trunks, and a few drops into each foramen. There was only slight irritation and very little edema. The second day following the operation all of the neuralgic pains had disappeared; on the third day anesthesia of the left side of the forehead, left cheek, nose and upper side of lip, also on the left lower lip and chin, ex-

tending back to the angle of the mouth. The face was swollen and continued so for about three weeks, but gradually subsided. In a letter dated July 2 the patient states that she is entirely free from pain and has had a month of comfort and ease which she never expected to experience again. In a letter, August 8, patient states that her condition is just as satisfactory as it was on July 2.

In a third letter, dated September 9, the patient states she is still free from pain. The upper and lower incisions are still suppurating, the latter quite freely. The inferior maxillary nerve protruded, and about one inch in length, very much blackened, was pulled out.

**CASE 12.**—Mrs. D. H. K. Age 62 years. Admitted to Mercy Hospital June 20, 1904. Discharged July 6. Family history negative.

*Personal History.*—Married at 30; has four children living; no miscarriages; no evidence of specific infection. Menstrual history began at 15; regular; duration three days; painless; menopause at 45.

*Present Illness.*—Nine years ago patient began to notice sharp, cutting pain along the angle of the left lower jaw. It remained confined to that locality for a few weeks, then extended to the outer angle of and above the left eye. Eight years ago the infraorbital branch was resected. Following the operation she was free from pain for six months. Then it returned with more intensity and in a larger area; always on the left side. She has had the "rest cure" in New York, but received no relief. Three years ago she was again operated on and portions of the supramaxillary resected, back into the orbit. This gave her relief for eight months. Since that time pain has been constant on the inner side of the cheek, in the gum, left lower jaw, above and below the left eye. The pain was intense if she was exposed to draughts, taking cold drinks, eating, talking, or on contact of any material with the face. She has been compelled to live on liquid foods and to take them through a tube or drop them into her mouth. She has emaciated considerably. This case, having had a division of the nerve on two occasions, was not a favorable one for the injection.

*Operation.*—June 23. The supra- and infraorbital nerves were found freely developed and about their normal size, notwithstanding they had been resected. The mental branch had also regenerated and was larger than normal. The foramina as well as the nerve trunks were injected with the usual quantity of 2 per cent. solution. There was slight suppuration around the mental foramen. These wounds are subject to infection from the mouth and as the osmic acid produces necrosis of the tissue *in loco*, they are, therefore, very liable to infection.

In a letter received from this patient July 21, 1904, she states there has been no return of the pain. There is still some slight discharge from the incision at the mental foramen. In a letter received August 20 the patient says that her case is progressing favorably. There is some discharge at the foramen menti and some slight induration at the infraorbital foramen.

**CASE 13.**—Mr. J. E. V. Age 60 years. Admitted to Mercy Hospital July 10, 1904. Discharged July 18. Family history negative.

*Personal History.*—Married twenty-eight years; has been a heavy smoker; very moderate drinker, and has always been well and strong. No specific disease.

*Present Illness.*—July 16, 1901, was sitting at his desk talking to his secretary when he suddenly lost his power of articulation. He did not fall out of his chair; just leaned over on his desk. He was not able to speak, but was sufficiently conscious to understand what his secretary was saying. This attack of inability to speak lasted a couple of minutes only. Immediately thereafter patient stood up, but felt very weak in his legs. Half an hour later he was able to walk to his carriage and go home. For ten days following this his mental condition was not exactly clear and he did not have entire control of his words, that is, he would endeavor to say one thing and would say something entirely different. The patient says

he was told at a Michigan sanitarium that he had softening of the brain. He was treated for five weeks at Detroit and regained control of his power of articulation and expression.

In September, 1902, patient began to have very severe headaches; they were "all over his head," but were especially bad in the frontal region. They continued all fall with only slight intermissions. In January, 1903, patient began to have severe pain just under the angle of the upper lip on the left side of the face, over the left cheek, the outer canthus of the eye and the left eyebrow. There was some pain in the lower lip and roof of the mouth. This came on in spasms whenever he partook of food or drink, touched his face, or was subject to a draught. The pain was intense, totally incapacitating him. He was under strychnia treatment by a celebrated neurologist with apparently no effect. The pain was present during all of his waking hours and frequently roused him from his sleep. He became emaciated and finally resorted to large doses of opiates.

**Examination.**—The patient will not permit one to touch any part of the left side of his face. He is fed by lying flat on his back and having the food dropped from the end of a spoon into his mouth. He does not permit it to touch his hard palate, his teeth or the anterior portion of his tongue. When it does there is severe spasm of pain. The posterior palatine, supraorbital, infraorbital, anterior palatine, mandibular and anterior auricular branches are all disturbed. He has never had an operation.

**Operation.**—July 10. The supraorbital branch was exposed by external incision; the infraorbital and mental branches through the mouth. The posterior palatine was a little difficult of exposure, but was finally hooked up. All of these branches were injected with from 7 to 15 minims of a 2 per cent. solution of osmic acid and the wounds closed. There was some suppuration from the infraorbital area. The second day after the operation there was a very slight twinge of pain. From that time up to date he has been entirely free. The pain in this case was located on the left, the same side on which he had his central cerebral lesion, which affected his speech, about two years previous, and would suggest that this central lesion was the cause of the pain.

He discontinued his morphin at once. The suppuration in this case extended along up the line of injection, in the foramen to the orbit, necessitating a small incision in the lower lip for drainage.

His report on August 25 states there has not been the slightest recurrence of the neuralgic pain.

CASE 14.—Mrs. C. W. S. Age 47 years. Admitted to Mercy Hospital July 1, 1904.

**Family History.**—Father and mother living.

**Personal History.**—Has been married twenty-seven years; two children; no miscarriages; no evidence of specific infection. Menstrual history began at 12 years; regular every twenty-eight days; menopause three years ago. Menstruation was never painful; gave her no discomfort.

**Previous Illness.**—Had rheumatism some years ago.

**Present Illness.**—In the fall of 1896 patient noticed a small tumor on the right side of the lower lip. It was present for four months. Her family doctor pronounced it carcinoma and had it removed by paste. Seven years ago last April patient had a severe attack of bronchitis; during this attack she sat up in bed to cough when she was suddenly taken with a severe cutting pain on and along the right side of the nasal cavity. This pain gradually extended over the right side of the face into the right upper gums and into the lower jaw. The pain lasted but a short time, but returned every time the patient partook of food, hot or cold drinks, or whenever her mouth was open to draughts, or if a draught passed over her face. This condition lasted about six weeks. During the summer of that year it entirely disappeared. In November of the same year she was attacked with the same type of pain, but over a larger area, and it was particularly severe in the right eye; always aggravated by exposure to cold, the taking of food or liquids, or the moving of her lips, washing the face, etc. The following summer there was slight relief.

In March, 1899, patient was operated on and the infraorbital nerve resected. Patient was entirely free from discomfort for one year.

In March, 1900, patient began to again have pain below the right eye and in the right upper jaw. This time patient had all of her teeth extracted. This relieved her of all pain up to October of the same year. Again the pain returned in the same positions. In July, 1900, patient was again operated on, resecting the stump of the infraorbital and the supraorbital nerve. Following this patient had no pain up to June, 1903, when it returned in the former locations. In July, 1903, she had a third operation on the same nerves. After this she was free from pain until March, 1904. Since that time the pain has been intense all over the right side of the face and right side of the mouth and gums; it has been constant, with occasional relief for a week or two. During most of this time patient has had occasional attacks of dysuria. These have no special relation to the neuralgic attacks. The sensation to touch, heat and pain have returned all over the face, notwithstanding the resection of the nerves, but it is somewhat perverted. She states that after each resection there was anesthesia over the area supplied by the nerves resected, but that after some months this anesthesia disappeared and the face assumed practically its normal sensibility.

**Operation.**—July 20, 1904. Supraorbital and infraorbital branches had redeveloped to about their normal size. The mental branch was represented by a small threadlike nerve escaping though an opening one-third of an inch above the original mental orifice, which had filled by new bone after the last operation. The supraorbital, infraorbital, mental and posterior palatine branches were all injected, as well as the foramina, with the usual quantity of 2 per cent. solution. The day following the operation she had some pain; on the second day after there was entire absence of neuralgic pain. In a letter August 20 the patient states the relief has continued up to date.

#### RESULTS.

The results obtained by operations may be divided into: First, the resections of the nerve trunks, extracranial; second intracranial divisions; third, ganglion removal; fourth, sensory root division or avulsion. From the standpoint of danger to the life of the patient, the extracranial may be said to be free from danger except in senile patients, when any operation has in it elements of danger. The relief from this type of operation has in a small percentage been permanent. In a very large percentage it has lasted from nine months to three and a half years. In all of the intracranial operations there are about the equal elements of danger, as the exposure of the nerve branches, ganglion and motor root is the most difficult and dangerous part of the procedure. The seriousness of this procedure has been impressed on me by four deaths in my 12 cases, a mortality of 33 1/3 per cent. Two of these deaths occurred in patients over 80 years of age. The analysis of 108 cases collected by Tiffany, as shown in the following table, shows the great mortality of these operations—great, since the disease, *per se*, does not threaten life.

#### TYPE OF OPERATION.

Nearly two-thirds Hartley-Krause, nearly one-fourth Rose's, 7 Horsley's, 4 Doyen's, 4 Quenu's, 1 Novaro's, 1 no method mentioned.

Nerves affected: Right side twice as often as left; third division alone 10 times, second division alone 6 times, first division alone none; involvement usually reflex. All divisions 22 times, second and third divisions 68 times.

Mortality of 108 cases, 23 died—22 per cent.

Cause of death: Shock, 8; sepsis, 8; brain trauma, 2; brain abscess (trauma?), 1; brain trauma and edema of lung, 1; apoplexy on tenth day, 1; cause unknown, fourth day, 1; cause unknown, sixth day, 1.

"Recurrence of pain after removal of gasserian ganglion is

not recorded." The author says "it can not occur." But the clinical fact is that it *does* recur in quite a percentage of cases in which the ganglion has been supposedly removed, and recent experiments support the clinical phenomena that it can and should recur. The immediate result of intracranial operation, whether section or removal of ganglia, is relief of pain. Recurrence in cases of excision are not uncommon.

Ordinary sensation in the territory supplied by the nerve operated on is abolished over a small area and exists irregularly over a large area. Ordinary sensation will be found where pain sense is absent. Sensations of heat and cold are frequently forfeited. Tiffany gives the following indications for operation: 1. If more than one branch is affected. 2. If painful area receives filaments from branches near exit from head (cranial cavity), *e. g.*, tongue, temporal region. 3. If pain is not an expression of constitutional disease. 4. If cause central to ganglion does not exist. 5. If other measures have failed to relieve.

Operation: Removal of lower two-thirds of ganglion, together with second and third branches as far as their foramina of exit from skull all in one piece, so as to be certain of amount of tissue taken.

Upper one-third of ganglia and first branch should not, for the present at least, be excised for neuralgia.

#### CONCLUSIONS.

From clinical reports, my experiments and personal clinical experience I conclude as follows:

1. That trifacial neuralgia, *tic douloureux*, is not the result of a pathologic entity which has so far been definitely determined.

2. The tendency after all types of operation, with the possible exception of removal of the sensory root behind the ganglion, is to recurrence of the disease.

3. This is probably due to the regeneration of certain nerve elements following the deep operation, and anastomosis and retention following the superficial.

4. Sudden shocks and irritation to the terminal filaments of the trifacial not infrequently cause an immediate and occasionally a permanent cessation of the neuralgic pain.

5. The mortality from the superficial exsections is practically *nil*; the mortality from the intracranial operations is great. The hazard is greater than should be taken in a disease which does not in itself jeopardize life.

6. Injections of osmic acid in 1 to 2 per cent. solution into the nerve trunks relieve the pain immediately and in a large percentage of cases for a long period of time.

7. The injections into the superficial tissue for peripheral neuralgia should be abandoned, as the nerve trunks are easily located, and there is no danger of superficial necrosis following such operation.

8. It should never be injected into a motor nerve or a motor nerve area and, therefore, never into the spinal nerves except in amputation stumps.

9. It produces a local necrosis of the tissue into which it is injected and even of the wall of the foramen. This necrosis does not suppurate unless the area is exposed to mouth infection. In that case the suppuration often continues for weeks, draining into the mouth, giving no special inconvenience, and in no way interfering with the final result.

10. The best results are obtained with a 1½ to 2 per cent. solution; this should be injected in many places into the nerve trunk and also into the foramen.

11. All of the nerve branches should be injected—the palatine, lingual, mandibular, superior maxillary (infra-orbital), and supraorbital. They can all be exposed through mouth incisions, except the supraorbital. Many times there are three or four divisions of the supraorbital

and they should be searched for carefully and each injected. Occasionally it is necessary to inject the auricular branch. The posterior palatine is not so difficult to inject as one would at first imagine.

12. The foramina can and may be injected without anesthesia or incision. The procedure is quite painful, however, and is not certain in its results.

13. The injections can be made with local or general anesthesia. I prefer the general.

14. The injection is free from danger.

15. Judging theoretically from the experience with incisions, resections and ganglion operations, the relief *should not be permanent after the injection of the osmic acid*. From clinical experience up to date, however, and particularly from Mr. Bennett's showing, the fact is that many cases *are* permanently cured. Time alone must determine the final result of this treatment. Its ease of application, its *nil* mortality, and its immediate results forcefully commend its use.

100 State Street.

#### DISCUSSION

ON PAPERS BY DRS. SHERMAN, FRAZIER AND MURPHY.

DR. CHARLES K. MILLS, Philadelphia—For many years I have had an opportunity of observing many cases of *tic douloureux*. With the exception of the osmic acid treatment, I have had my cases treated by all forms of surgical procedure. In order that you may have pain in the fifth nerve or anywhere else three things are necessary: 1, Peripheral sensory irritation; 2, channel of communication, and, 3, cerebral centers for the conscious recognition of pain. It does not matter what the pathology of this disease is. The essential thing in its surgical treatment is the complete separation of the cerebral centers concerned with sensations from the periphery. I believe that the best method of treatment is either extirpation of the gasserian ganglion or section of the sensory root, but I am somewhat unsettled which should receive the preference. However, it matters little which is done if the operation is performed successfully. In some cases, perhaps, the sensory root operation is better on account of the effect on the eye from the gasserian operation. My reason for not favoring the osmic acid treatment is that I am usually not inclined toward any peripheral treatment. Experience shows that when one branch of the fifth nerve is involved, sooner or later others, and perhaps all, will be implicated.

DR. WILLIAM G. SPILLER, Philadelphia—As to the pathology of *tic douloureux*, I have had an opportunity of examining many gasserian ganglia, probably about 15, removed at operation, and have always found degeneration. It matters little whether the disease begins in the peripheral nerve fibers or in the ganglion, because it can not exist long in the former without affecting the nerve cells of the gasserian ganglion. The alteration sooner or later involves the whole nerve structure, including ganglion and peripheral nerve fibers. The relief of pain after resection of a peripheral branch does not prove that the lesion is primarily in the peripheral branch. The cells of the ganglion are altered by the resection and their function is partially impaired, and until they recover pain is not likely to return. I was surprised to hear Dr. Murphy say that there was no ascending or descending degeneration in his experimental cases. I do not understand how axis cylinders can be destroyed without causing secondary degeneration. The method recommended by Dr. Murphy is most valuable if the relief is permanent. The action of the osmic acid is to cause destruction and hardening of the tissue into which it is injected. Osmic acid is one of the best hardening agents, and when injected into a nerve it probably makes regeneration more difficult. Dr. Sherman's case is important, but it is not at all a typical one. He states that pain returned on the third day, and I can not understand how the sensory root could have been entirely divided if pain returned within so short a time. Very few gasserian ganglia have been entirely removed without relief of

pain; indeed, I know of only two cases, and I am skeptical concerning these. Sensation sometimes returns in peripheral nerves before motion, but if there were a regeneration of the fibers of the sensory root it is probable the fibers of the motor root would also regenerate, and there would be some return of motion in the muscles of mastication, which I have not heard was present in Dr. Sherman's case. It would be well to resect a piece of the sensory root to make sure that division is complete. The operation on the sensory root is difficult and very bloody, and one may easily be deceived regarding complete division of the root. In the dogs examined by Dr. Frazier and myself I found that the external part of the sensory root was more frequently degenerated than the internal part, and that the fibers of the external part of the root were represented in the posterior part of the descending spinal root. Combining the results of my studies with those of Van Gehuchten, I believe we may say that the fibers of the third division of the trigeminus are represented in the external part of the sensory root and in the posterior part of the spinal root, and that when the anesthesia is of very limited area after an operation on the sensory root, it will be found in the distribution of the third division, and that this indicates that only the outer part of the sensory root has been injured at the operation.

DR. ROBERT F. WEIR, New York City—The osmic acid treatment failed in my hands many years ago, and I do not see how it is any better than the resection of a certain portion of the nerve. The nerve is destroyed by the acid, as would be the case with a resection. The intervention of gutta-percha tissue between the nerve ends, or under the dura, to prevent adhesions has been tried by myself with failure as a permanent result. I have also employed gold leaf with the same intent. In one case of trephining I had put in a small gutta-percha sheet; the wound healed, but headache resulted and persisted. On cutting into the scar several months later I found that this gutta-percha tissue was still there, and that it was finely perforated, allowing in many places adhesions to pass through it. This condition was also observed in another case. I am, as others have been, driven to the conclusion that for the permanent relief of these trigeminal neuralgias we are bound to resort to an intracranial operation, which has a very serious risk, for we are resorting to an operation that brings with it a risk of death for a disease that has no such risk. I yet believe it well to try the lighter operations first.

DR. J. SHELTON HORSLEY, Richmond, Va.—Ten years ago it was held by many surgeons that the spinal cord after being injured, particularly in its upper portion, never regenerated, but Harte and Stewart reported a case where this view was shown to be incorrect, as the patient recovered quite satisfactorily after complete section of the cord at the level of the seventh dorsal vertebra. We must consider the idiosyncrasy of the patient. In some individuals regeneration of nervous structures takes place, whereas in others there will be no attempt at repair, though the lesion may be identical in both instances. There seems no way of telling whether a nerve in a given individual will repair until an actual trial is made. I have done two operations on the gasserian ganglion, and both resulted satisfactorily. In one case the whole ganglion was removed intact. The external carotid was ligated, which lessens hemorrhage and adds to the confidence of the operator. The Cushing operation gives a very satisfactory exposure if carried farther under the base of the skull, somewhat after the method of Doyen. I have tried to mitigate the shock by the hypodermic injection of cocaine into the ganglion before division of the nerves, but the patient suffered shock to some extent, the blood pressure dropping to 80. I do not know how much good the cocaine did. In the second case, the Abbé operation was performed. Only the second and third divisions were involved here. There must be a legitimate field for extirpation of the gasserian ganglion, as Spiller and others have demonstrated that in nearly every instance after persistent tic this ganglion shows pathologic lesions. Milder operations may sometimes succeed, but they can not supplant the more radical procedure.

DR. JOHN B. MURPHY—I have had many cases of tic, and I know the "real thing" when I see it. I am not a novice in the

work. I lost three cases out of eleven following the operation of ganglion removal. Dr. Spiller's experience in pathologic findings has not been supported by others. I had one case from California in which every branch was involved, and so severe was it that a doctor had to accompany her to Chicago for the operation. I did the injection method and completely relieved the patient by the end of the third day. As to what Dr. Weir says about nerve regeneration, there are some things that we do not understand. At times, in contusions or pressure on a nerve without division, some change occurs to interfere with the re-establishment of communication between the periphery and the centers and prevents the return of function. I hope to get the same result from the injection method and we are justified in this hope by Mr. Bennett's experience, extending over a period of six years. It is my opinion that the results should not be permanent, but the clinical test is the final test, and so long as I am able to relieve these cases for even a year or two by this simple and safe procedure I will not again resort to the ganglion removal. The ganglion removal is ideal, but the hazard is too great except as a *dernier ressort*. The injection may be renewed with benefit, as shown by Bennett's and my cases.

DR. H. M. SHERMAN, San Francisco—As to the question of the return of pain referred to by Dr. Spiller, its return and persistence suggests strongly the idea that the disease and the cause of the pain is central. The persistence of the paralysis shows that I had surely cut all the sensory fibers, but the return of sensation led me to think that there was some error in the proposed technic of the operation. After the second operation we have permanent anesthesia, but still a persistence of the pain. In this second operation the ganglion was removed.

DR. C. H. FRAZIER—With reference to the occurrence of facial paralysis as a complication in the operation on the gasserian ganglion, I have explained it in one of two ways; it may be due either to the forcible retraction of the musculo-cutaneous flap with a metal curved retractor, the tip of which may easily exert enough pressure on the facial nerve to cause at least temporary disturbance of function, or it may be due to too forcible and prolonged elevation of the temporal lobe. The time has come when we should discard the percentages which have been estimated from the series of cases operated on before the adoption of the more perfect methods of modern technic. The operation on the ganglion itself, the central or peripheral roots, is no longer a "kill or cure" measure. I am not prepared to accept the report which Dr. Sherman has made as conclusive evidence against the rationale of the operation which I have advocated. I still believe regeneration of the sensory root will not occur after its division, and, therefore, that there can be no recurrence such as Dr. Sherman has reported. It is more than probable in this case that the root was not entirely divided. It is a source of disappointment to me that such a report should have been made, inasmuch as it will throw some doubt on the accuracy of our observations. The operation was based on the results of very careful and painstaking experimental investigation by Dr. Spiller and myself, and not until we obtained encouraging results in these experiments was the operation applied to the human subject. I believe the operation to be established on a sound and scientific basis, and the results of our clinical experience would seem to bear me out.

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**A New Cure for Drunkenness.**—The Norwegian authorities, who do not make light of the subject of alcoholism, are using an original method of curing drunkards of their vice, according to *Le Bulletin Médical*. The patient is placed in a room under lock and key, and all outside communication is cut off. His nourishment consists in great part of bread soaked in port wine. The first day the drunkard eats his food with pleasure, and even on the second day he enjoys it. On the third day he finds that it is always the same, on the fourth day he becomes impatient, and at the end of eight days he receives the wine with horror. It seems that the disgust persists and that this homeopathic cure gives unexpected results.