was removed with the sac and the patient did well. (2) The other patient had a large right-sided tubal gestation with a very long appendix lying across and adherent to it; the appendix was gangrenous and a large concretion was just bursting through its tip. The gestation sac was full of thin, foul-smelling fluid; no embryo was found, but there was an abundance of necrosing chorionic tissue.

Hysterectomy for other Causes.—Most of the cases were for acute puerperal peritonitis; here the appendix was four times removed, twice being acutely inflamed. In both cases I feel certain that it was the cause of infection.

Appendicitis.—There were two cases, in the series, of appendicular abscesses complicating pregnancy at the seventh and eighth month. Four were found when operating for "cystic ovary." The ovaries were left, and the patients' symptoms have been cured completely by the removal of the appendix.

Deaths.

I have not found any reason to think that the removal of the appendix in any of these cases has been prejudicial to recovery or convalescence. There have been eleven deaths among the 300 cases—as follows:

Fibroids ...	2
1 from cardiac failure—aortic regurgitation.	
1 from pulmonary embolism.	
Ovarian ...	1
Malignant.	
Other hysterectomies ...	4
3 from puerperal peritonitis	
1 from criminal abortion, with perforated uterus and gas gangrene.	
Wertheim's hysterectomy ...	1
From shock.	
Pyosalpinx ...	2
1 from shock.	
1 from peritonitis.	
Myomectomy and pregnancy ...	1
Miscarriage and pulmonary embolism nine days after operation.	

In only one of these cases was the appendix removed; the patient had pyosalpinx, and died of peritonitis from which the gonococcus was recovered, so that I do not think that the mortality rate has been in any way affected by the removal of the appendix.

Among the oöphorectomies two cases became infected in the abdominal incision, and possibly the appendicectomy was the cause of this occurring; otherwise the removal of the appendix seems to have caused no risk to the patient and has only occupied a few minutes. In 23 cases out of the 300 the appendix was acutely inflamed and would have required removal in any case.

I have found it very difficult to obtain any definite information as to the position of the appendix in health, but it appears that most of the authorities consider that the appendix may be below the brim of the pelvis in about 50 per cent. of cases, and also that in a large number of cases there is a definite anastomosis between the branches of the ovarian and appendicular arteries.

Conclusions.

1. The appendix is very likely to be affected by pelvic inflammations and may be the cause of salpingo-oöphoritis and its consequences more frequently than is expected.

2. The appendix should be suspected and examined in all cases of pelvic peritonitis, and it should be removed if it is in any way diseased, to prevent further trouble at a later date.

3. Even when the operation is performed for a condition which is not inflammatory the appendix should be examined; 20 per cent. of my series show definite disease of this organ, and 2 of the 31 appendices removed were reported as malignant.

4. Acute pyosalpinx is frequently complicated by acute appendicitis and vice versa.

5. "Oöphoritis" as a disease, and apart from pelvic peritonitis, should not be diagnosed. If at operation the ovaries are found to be merely enlarged and not adherent, then the appendix is most likely to be the cause of the

patient's pelvic pain. In corroboration of this, the number of oöphorectomies performed at the Royal Infirmary has fallen to a quarter of the number which were done before the war, and the results as to the cure of chronic pain have very greatly improved.

6. I would advance with great diffidence that it is just as well to remove a pelvic appendix whenever found, even if it appears quite healthy to the eye.

In conclusion, I wish to express my gratitude to Drs. Kay-Mouat, Fraser, and Todd for cutting numerous sections of appendices and tubes in the pathological department of the Royal Infirmary.

THE RADICAL TREATMENT OF TRIGEMINAL NEURALGIA

AS EXHIBITED IN SEVENTEEN CONSECUTIVE CASES.

BY

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SOME ANATOMICAL CONSIDERATIONS.

The fifth cranial nerve is a fairly typical dorsal nerve. What is the corresponding ventral nerve, and, still more important, what is its portion in the sympathetic chain? There are at least four ganglia, sympathetic in structure, connected with this nerve—namely, Meckel's, Arnold's, the ciliary, and the submaxillary. They receive their efferent fibres from the third and seventh cranial nerves, which must therefore be regarded as the ventral element, while their afferent fibres are supplied indirectly from the superior cervical ganglion. It is of importance to note that the cell stations of the sympathetic nerves are within these ganglia, and not in the ganglion of the dorsal root (the Gasserian ganglion) or the cord.

PATHOLOGY.

Our present knowledge of the pathology of tic-douloureux is both unsatisfactory and unreliable. Degenerative changes of a doubtful kind and a round-celled infiltration have both been described as occurring in the Gasserian ganglion. Pressure on the ganglion by tumours can, according to some observers, give rise to a "true" tic (a very doubtful proposition). In sections of the ganglion removed at operation I have not been able to confirm any of these findings, not even in the minutest degree. My own most constant finding is a hypertrophic obliteration of the arteries of the ganglion itself due to hypertrophy of the circular muscular coat. It is not a condition of endarteritis. The change is identical with that seen in the arteries of the feet in that particular type of Raynaud's disease associated with intense pain of an unbearable kind in which patients readily submit to amputation in order to obtain relief. Similar changes were seen in the arteries of men who suffered with trench feet and the accompanying erythromelalgia.

This is the only change I have been able to find in the Gasserian ganglia of patients suffering from true tic, and it is of important significance. It suggests arterio-spasm, arterial cramp, a condition allied to angina which might suitably be called "arterial angina." It is an angioneurosis, brought about by some sympathetic unbalance.

If this be correct, afferent painful impulses from the arteries will travel by way of the ganglia mentioned, passing thence via the posterior nerve roots to the brain. This view is strengthened by the fact that removal of Meckel's ganglion gives complete relief in instances of tic affecting the middle division of the trigeminal. Interesting in this connexion are certain methods of treatment, hitherto empiric, such as removal of the superior cervical ganglion, ligature of the carotid arteries, which in this connexion is similar to removing the superior cervical ganglion, the exhibition of iodides and belladonna, and the use of amyl nitrite for relieving the spasm when at its worst.

SYMPTOMS.

The disease manifests itself at first in short lightning attacks of pain which start at some definite point, usually in the upper lip, or in one or more teeth of the upper jaw. The pain tends to spread from the starting-point and involves other areas. Starting in one or more teeth of the upper jaw, it spreads backwards and thence into the third division, lastly affecting the eye. On the other hand, but more rarely, the attacks may originate in and remain confined to the first division. The intervals between the attacks are at first considerable—weeks or even months. As the condition progresses the intervals between the attacks become shorter, and the spasms both longer in duration and more severe in character. At first the trouble is thought to lie in the teeth, and usually they have been extracted.

When the condition becomes fully established the attacks are very typical. A glass of cold water, a cup of tea, or even going out of doors, is quite sufficient to excite a paroxysm. The patient holds his head in both hands; lightning pains, causing indescribable agony, prevent him from moaning or uttering a cry; the facial muscles twitch, specially those of the eye; the lacrymal and salivary glands secrete, the pupil on the affected side dilates; following the spasm the face flushes on the side affected, and unilateral sweating occurs. Repeated attacks rapidly reduce the patient to a complete wreck, and unless relieved sufferers will themselves seek relief in self-destruction.

The pain is obviously not a neuralgia or a neuritis; it is a cramp, an arterial angina the result of arterio-spasm. It is due to some uncontrolled activity of the vasomotor nerves. The more I see of the condition the more convinced I am that this is the case.

TREATMENT.

Treatment lies between alcohol injections into the nerve or its ganglion and radical operative treatment. Alcohol injections may give permanent or temporary relief—most often the latter, the recurrences being worse than the original attacks. Twelve of my cases had alcohol injections before coming to me, and of these four were unable to open their mouths to the full extent owing to fibrosis of the masseter and pterygoid muscles following the injections.

Surgically several operations have been practised, but I have confined myself to the following three: (1) division of the sensory root; (2) division of the second and third divisions; (3) division of the second and third divisions with removal of the outer third of the ganglion. I do not think it matters whether the sensory root is divided or whether the second and third divisions are divided. The important point is to divide the nerves proximal to Meckel's, the otic, and submaxillary ganglia.

In my experience division of the sensory root is the easiest of the three operations. I performed this operation in five of my cases, and in every instance troublesome eye symptoms occurred; consequently I have abandoned it (Frazier-Spiller operation). I performed Hutchinson's operation (3) in four cases, and in my opinion this is the most difficult operation, as haemorrhage is apt to occur however careful and patient one may be. I performed a modification of Abbe's operation (2) in eight cases, twisting the proximal ends of the divided divisions and pushing the distal ends through the oval and rotund foramina, finally plugging the foramina with cotton-wool. In operations (1) and (2) there have been no eye-symptoms and relief has been permanent.

It is only fair to state that any of these operations are difficult, and each surgeon will be guided by what he finds in his hands is the most expedient method. They are operations not to be undertaken lightly, and not before several attempts have been made upon the cadaver. I use an incision starting just behind the pinna, curving upwards in semicircular fashion to end at the mid-point of and just below the zygoma. The flap is turned down, and with it the posterior half of the zygoma as far as the infra-temporal crest. The pin of the trephine is placed just above and in front of the triradiate process of the zygoma, and a circle of bone is removed. This done, the dura is detached to the extent of three-quarters of an inch around

the opening, which is enlarged inferiorly as far as the infra-temporal crest and no further; otherwise the pterygoid plexus of veins may be injured and troublesome haemorrhage will make clear work impossible. I now detach the dura from the base of the skull with the gloved finger until an obstruction is reached. This obstruction is the third division. Reference to a skull will make this plain. The bent handle of a dessert-spoon is now introduced as a retractor to elevate the brain, and strips of gauze soaked in hydrogen peroxide are packed in between the handle of the spoon and the base of the skull. These are left in for from three to five minutes. This renders the field wonderfully clear, and arrests what little oozing there is from the bone. The second and third divisions are readily identified, when the gauze strips are removed with the middle meningeal artery, whose relation to the roots is inconstant. Any of the three operations can now be completed. If the sensory root is to be divided the middle meningeal artery is divided after plugging the foramen spinosum with a small plug of cotton-wool. The dura is divided along a white line which marks the line of fusion of the dura propria around the third division. The ganglion is thus exposed and traced backwards to the sensory root. This is then divided, sparing if possible the motor element lying beneath it.

If the second and third divisions only are to be divided they are seized with forceps and slowly twisted proximally after division, the distal ends being pushed through their respective foramina, which are afterwards plugged with cotton-wool. In my opinion this is the operation of choice, as there have been no recurrences after four and five years, which rather supports the theory that the condition is sympathetic in origin, and that the afferent cell stations are situated in the sympathetic ganglia. An attempt should be made to save the motor element of the third division. I have been able to do this in four of my cases, but in those in which it was apparently divided the inconvenience has proved slight.

The post-operative phenomena of interest are as follows:

- (1) Eye changes which manifest themselves in trophic conditions of the cornea. In one instance a conical cornea resulted with visionary disturbances.
- (2) Paraesthesias in the form of pins and needles travelling over the areas of the divided nerves—sometimes pain in the form of tic, but less severe and less frequent—curious sensations in the pharynx (pterygo-palatine nerve), a feeling of fullness in the ear on the same side (tympanic branch of the auriculo-temporal nerve).
- (3) Anaesthesia in part of the palate, tongue, and nose, resulting in the unconscious swallowing of foreign bodies—for example, plum stones.
- (4) Some paralysis of the palate on the same side which may rather interfere with speech (tensor palata via the otic ganglion).
- (5) Paralysis of the muscles of mastication with withering of the temporal muscle, and the consequent disfigurement if the motor root is wholly divided.
- (6) Temporary mental symptoms.

It is of interest that post-operative infection of the respiratory annexes and trophic changes in the mucosa have been conspicuous by their absence.

Of seventeen cases operated upon four were male and thirteen female—that is, 75 per cent. female. There were two deaths—one a woman, aged 75, with advanced aortic disease; the other a woman, aged 65, whose general condition was exceedingly poor. This gives a mortality in this series of 11.8 per cent. With some diffidence I connect their deaths with the operation, but it will, I hope, prove that the cases were in no way picked.

In competent hands and in suitable cases I think that to-day this operation can be undertaken in perfect safety; in not one of my cases has there been recurrence. The first case was operated upon six years ago; in one instance there were symptoms on the opposite side, which subsided. In view of what has been said in the text the radical cure is correct both scientifically and practically, and is undoubtedly preferable to alcohol injection, which is but palliative and temporary.