

PULSATING EXOPHTHALMOS DUE TO TRAUMATIC ANEURISM OF THE INTERNAL CAROTID ARTERY.

REPORT OF A CASE CAUSED BY A BULLET WOUND OF THE BASE OF THE SKULL.

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W. C. was a ne'er do well, aged forty-two years, who shot himself in the mouth with a revolver, and was found bleeding from the mouth, nose, and left ear in a field thirty-six hours after the injury was inflicted. Dr. Denning, of Epping, under whose care he came on October 16, 1901, sent him up to the London Hospital under my care.

When he was admitted on October 16, 1901, a ragged wound was found running upward and backward through the tuberosity of the superior maxillary bone to the base of the skull, which was perforated and smashed in the region of the left petrous bone. The wound was foul and the breath fetid. The left side of the face was paralyzed completely. The left eye was protruded and the pupil dilated and fixed. Complete external ophthalmoplegia was present and the left cornea was insensitive, the eyelids were swollen and very prominent. When the eye was palpated, it was found to be pulsating vigorously; a thrill was present, and a bruit was heard with a stethoscope over the eyelids. On compressing the carotid in the neck the eye receded and the pulsation disappeared. The conjunctiva was cedematous, and soon this cedema increased so much that the mucous membrane herniated between the lids.

The left side of the face was completely paralyzed, but the movements of the palate were normal. The sensation of the face and neck was unimpaired and the movements of the tongue unaffected. Blood and cerebrospinal fluid escaped from the left ear, and the patient was quite deaf on that side.

Mr. Rigby kindly saw the case with me, and we decided it would be best to ligature the left common carotid, and so attempt to save the left eye, and at the same time cure the arteriovenous communication which we supposed existed. To ligature the common carotid in a case of arteriovenous communication in the cavernous sinus which has existed for a long time is not a rational procedure, for one of two things may occur. Either the collateral circulation is good, in which case the exophthalmos will relapse almost immediately, or it is not good, when hemiplegia from anæmic softening will result.

In this case, however, the aperture of communication was recent, and, could we reduce the blood-pressure in the carotid for even a few hours, this aperture might well become closed permanently.

*Operation. Ligature of the Left Common Carotid; Slip-
ping of the Ligature; Method of Resecuring the Artery.*—The left common carotid was accordingly ligated in two places and divided between the ligatures opposite the cricoid cartilage and through a small wound. When the ligature was tied, the respirations immediately became deep and slow; the proptosis diminished and the pulsation in the upper and lower lids disappeared. The left pupil slightly dilated, but remained immobile to light. Feeble pulsation could be felt in the superficial temporal artery on the left side, and the superficial temporal veins were very prominent.

I am now aware that several errors were committed in the technique of this ligature. The artery should have been ligated in continuity, and there was no need to divide it. Division of large arteries between ligatures was a method introduced, I believe, by Sir Thomas Smith. It was intended to permit the ends of the artery to retract up the sheath, away from a wound which would certainly become septic, thus diminishing the risk of secondary hæmorrhage. Now that primary wounds heal uniformly by first intention, it is unnecessary to continue this procedure.

The wound was too small, and the sheath was only opened three-quarters of an inch, and, as a consequence, the two ligatures converged below the artery, and were no doubt tied obliquely around it, and certainly not more than one-eighth of an inch of divided artery projected beyond the central ligature.

I must, however, claim to have tested the central ligature fairly well by pulling on it before I cut it short and let the artery retract.

Whilst the wound was being closed, blood suddenly spouted up in great volume from the depth of the wound. I immediately plunged my right index down to the carotid sheath and plugged the hole in it with the tip of my finger. This practically stopped the hæmorrhage, but the anæsthetist had been told to discontinue the anæsthetic; the patient was coming round, and the rough pressure on the vagus caused spasm of the glottis and of respiration. A minute or so was spent in getting the patient deeply anæsthetized, and then I attempted to secure the artery by three distinct plans, only the last of which had any real chance of success.

First, I tried to grip the artery through the sheath below my finger with Spencer Wells forceps, but the sheath only slipped upon the artery, which indeed had retracted about an inch and a quarter.

Then I enlarged the wound with my left hand and tried to open the sheath below the end of the artery and secure the artery there, but I found the sheath infiltrated with blood at arterial pressure, and the first small aperture in the sheath I made spurted like an artery, and had to be secured with forceps. It was then that I saw that if the artery was to be secured at all, it must be low down where it left the thorax. I accordingly continued my incision to the sternum, separated and cut across the sternomastoid and omohyoid, operating all the time with my left hand. I then followed the pulsation of the carotid backward until it entered the thorax, and here compressed it against the body of the seventh cervical vertebra. On removing the right index, which had plugged the hole in the sheath all this time, no hæmorrhage occurred. Then taking a fine pair of scissors in the right hand I slit the sheath carefully down its inner side so as to avoid the internal jugular, which was distended from the pressure below. After slitting up the sheath for about three-quarters of an inch, the ligature was encountered, and about half an inch farther the round yellow end of the artery came into view. It was drawn out and secured by Spencer Wells forceps, and finally ligated with No. 4 silk. I have gone at some length into this accident because it is one which may occur to almost

any operating surgeon who divides large arteries between ligatures, and, secondly, because I have heard of two cases in which it happened to very eminent surgeons, and the artery was not secured, apparently because they restricted their efforts to the neighborhood of the wound in the sheath.

Progress.—The wound in the neck healed aseptically. The pulsation of the eye disappeared for four days; it then recurred, and finally disappeared about ten days after the ligature; but by this time the eye was blind and opaque.

For two months the progress of the case was uneventful. The profuse flow of pus from the mouth and ear gradually diminished. Boric acid syringed into his ear came out of his mouth. The temperature oscillated, but there were no cerebral signs.

The bullet had been localized by skiagrams taken transversely and anteroposteriorly, and was known to be lying at a depth of one and a quarter inches just above the petrous bone, and probably in the temporosphenoidal lobe. I did not attempt to remove it during this period, because I thought an arterio-venous communication might still exist, and that I might find the thin veins of the cortex distended and pulsating at high pressure and too frail to hold a ligature.

Just two months after admission the patient began to complain of headache, and his temperature rose to 100° F.; and on the following day he had a right-sided fit, chiefly limited to the face and arm and followed by decided weakening of the right-hand grip. The fit lasted seven minutes, and he was unconscious for four hours after it.

It was decided, in consequence of this fit, to remove the bullet and drain an abscess which was believed to exist around it.

Operation to remove the Bullet, December 24, 1901.—The first thing we did was to exactly locate the bullet by means of X-rays and the fluorescent screen.

On his way to the theatre, the patient was wheeled into the dark room and the X-rays of a Röntgen tube were directed exactly transversely across his skull.

The bullet could be clearly seen on the screen. A pin was then thrust through the screen in the middle of the bullet shadow until it impinged against the scalp. The lights were turned up and this spot marked with aniline dye on the scalp.

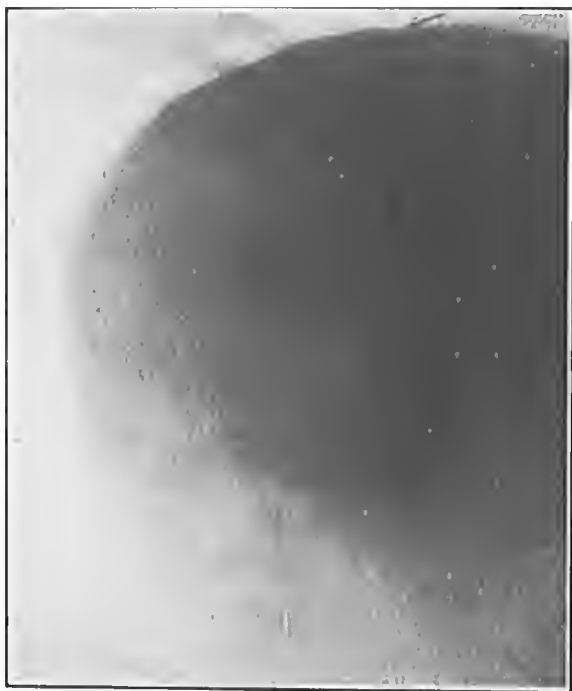


FIG. 1.—Skiagram of the skull of case of pulsating exophthalmos taken transversely, showing: (1) Bullet one and one-half inches vertically above the external auditory meatus. (2) The track of the bullet through the base of the skull.

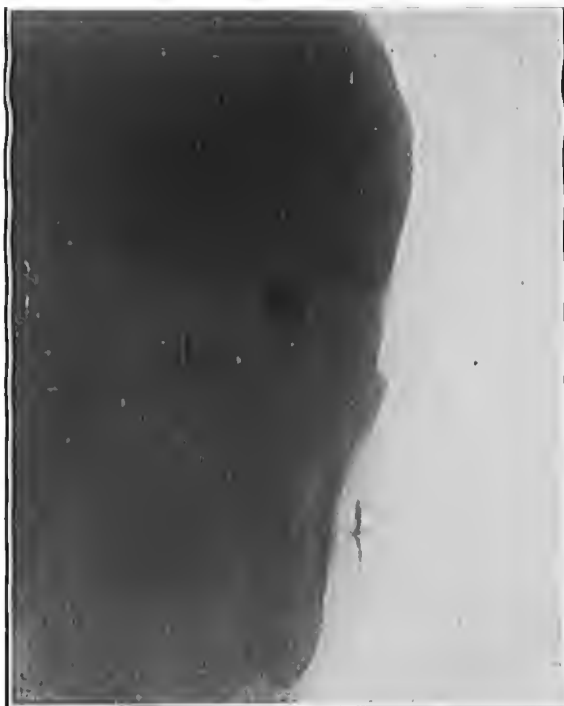


FIG. 2.—Skiagram of the skull of case of pulsating exophthalmos taken anteroposteriorly, showing bullet misshapen at a depth of one and one-half inches from the squamous bone, and one and one-half inches above the external auditory meatus.

This point was one and a half inches above and slightly behind the external auditory meatus.

In the theatre, this point was marked on the skull by a steel pin driven through the scalp. A flap was then turned down and the pin of the trephine applied to this point. A disc of bone no larger than a shilling was removed. The dura was incised and a director passed transversely across the brain. At a depth of three-quarters of an inch gas and foul pus escaped, and the director struck a sharp object, which was seized with forceps and removed. It was found to be a separated portion of petrous bone. The wound was then enlarged with forceps and much pus evacuated, and the little finger inserted into the abscess cavity. At a depth of one and a half inches the bullet was felt lying on the top of the petrous bone and still entangled in the dura with several small fragments of bone. It was removed. The abscess was irrigated out and a drainage tube inserted. The patient improved for a day or two, and then a hernia cerebri developed, and his temperature and pulse became subnormal. The brain was explored cautiously, but the abscess cavity was apparently efficiently drained.

He died with signs of cerebral compression two months and a half after the accident.

Autopsy.—A large abscess was found in the upper part of the temporo-sphenoidal lobe extending into the lower part of the Rolandic area. It was as large as a Tangerine orange. It did not communicate with the abscess around the bullet, which was efficiently drained. Apparently it had originated in the bruised area in front of the bullet, and was perhaps partly due to the anæmia produced by the ligature of the common carotid.

The left half of the skull as far back as the petrous bone was removed for careful dissection of the causes of the pulsating exophthalmos.

Mr. Hugh Rigby very kindly undertook the dissection, and has contributed the description which follows.

The illustration is by Mr. T. Wood Jones. The skiagrams and photograph of the bullet by Mr. Hamack.

Report of Dissection, and Remarks by MR. RUGBY.—There is a small circular hole situated on the inferior surface of the zygomatic surface of the great wing of the sphenoid left side.

A probe inserted into this, passed upward, backward, and slightly outward, and finally appeared at the ragged opening seen on the upper aspect of the base of the skull at the tegmen tympani. It must have passed in front and just external to the first curve in the intracranial course of the internal carotid in the apex of the petrous portion of the temporal bone. It likewise must have crossed obliquely and antero-externally to the left Eustachian tube and beneath the left Gasserian ganglion.

The superior maxillæ and pterygoid processes of the sphenoid bone had at the post-mortem examination been sawn off flush with the base of the skull. The path of the bullet from the palatal surface of the superior maxilla was up and back through the posterior part of the tuberosity of the superior maxilla and the pterygoid process to reach the zygomatic surface of the great wing.

On examining the base of the skull from above, a ragged hole about the size of a half-penny was evident at the site of the left tegmen tympani. There was an inch trephine hole in the squamous part of the left temporal bone. The only other thing to notice on the surface was a hard, firm, rounded swelling at the posterior part of the left cavernous sinus; this was thought to be a thrombosed cavernous sinus. A dissection was now made to expose the internal carotid artery in the whole of its intracranial course; at the post-mortem examination the supra-occipital had been separated from the exoccipitals with bone forceps. The basioccipital was cut through in a line from the anterior extremity of the condyle of the occipital to the posterior wall of the carotid canal, at the posterior end of the cavernous sinus. In this incision the inferior and superior petrosal sinuses were necessarily divided; they did not show any change from the normal.

A second incision was next made from the posterior condyloid foramen obliquely forward and outward to the jugular foramen.

The piece of bone (exoccipital) between the two cuts, foramen magnum posteriorly and petrous of temporal anteriorly, was then removed; the bulb of the lateral sinus was next opened up; this and the lateral sinus itself were quite normal. The portion of the petrous forming the inner wall of the carotid canal

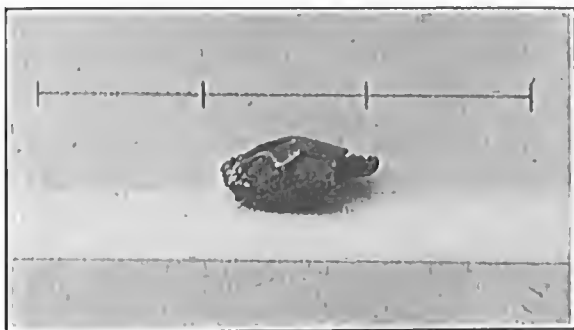


FIG. 3.—The bullet extracted from the brain of case of pulsating exophthalmos. Actual size.
The scale is in inches.

was next chipped away with the forceps and the carotid freely exposed from behind, from the entrance on the inferior aspect of the petrous to its exit on the lateral wall of the basisphenoid.

The Cavum Meckelii was next opened up and the Gasserian ganglion removed, the three divisions having been divided close to their exit from the skull. The cavernous sinus was next

FIG. 4.

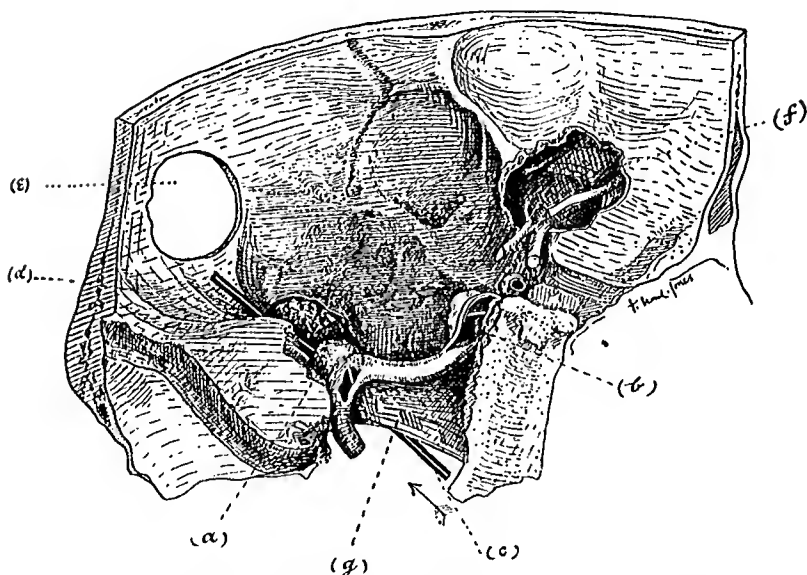


Diagram of a dissection of the specimen obtained from Mr. Barnard's case of pulsating exophthalmos, showing the left internal carotid artery in its intracranial course. The lumen of the artery has been opened up to show the mouths of the aneurismal sacs from within. The contents of the left orbit have been dissected from above.

The following are the points of interest in the diagram: *a*, Sacculated aneurism at the first bend of the internal carotid in the petrous bone adjoining the exit of the bullet in the middle fossa; *b*, sacculated aneurism at the second bend of the artery at the posterior part of the left cavernous sinus; *c*, glass rod indicating the track of the bullet, which passed from below upward; *d*, ragged hole in the tegmen tympani caused by the exit of the bullet; *e*, trephine hole in the squamous bone through which the bullet was extracted; *f*, the contents of the orbital cavity dissected from above; *g*, the Eustachian tube.

displayed by dissecting off the dura mater and the nerves on its outer wall.

The carotid exposed by this dissection was seen as follows. At the antero-external side of the artery at its first bend in the canal in the petrous bone was situated a small, well-defined sacculated aneurism filled with firm clot. Another aneurismal swelling, localized, oval, and filled with firm clot was situated on the outer side of the artery in the posterior half of the left cavernous sinus; the third, fourth, ophthalmic division of fifth, and sixth nerves were stretched on its outer wall.

The cavernous and the other sinusses in this region were small and empty of blood. No communication between the internal carotid artery and the cavernous sinus could be made out. The sphenoidal fissure was next opened up and the orbital plate of the frontal bone and lesser wing of the sphenoid cut through so as to expose the orbital contents from above; the fourth nerve, levator palpebræ, and superior rectus were divided and turned forward; the superior ophthalmic vein was then exposed; it was not enlarged, and contained practically no clot. The ophthalmic artery was small and quite empty. The optic nerve was intact, as were also the rest of the orbital nerves. The sheath of the optic nerve was more adherent than usual.

The chief points to note in this dissection are:

(1) The presence of a double sacculated aneurismal dilatation in the intracranial course of the internal carotid artery.

(2) That no arterial communication with a sinus was present.

(3) That, although the aneurismal sac in the petrous bone could be accounted for by the fracture of the tegmen, no such explanation can account for the aneurism found at the posterior part of the cavernous sinus. No radiating fracture across the base could be detected.

(4) The absence of any noticeable dilatation of the sinus or ophthalmic vein.

The interest of this case I think depends chiefly on the fact that all the typical signs of a traumatic pulsating exophthalmos were found to be due to a sacculated aneurism of the carotid, and not to an arteriovenous communication. That an aneurismal dilatation of the internal carotid in its intracranial course

can give rise to this condition has been much disputed. A reference to the best known articles on this subject leaves one greatly in doubt whether such a condition is possible.

Mr. Rivington's paper is perhaps the earliest series of such cases recorded; this appeared in the *Medico-Chirurgical Transactions* in 1875, Vol. lviii, p. 183.

He there gives an excellent *résumé* of the previous literature dating back to 1809, when the first recorded case of ligation of the common carotid for this lesion is published.

Rivington's paper consists of seventy-three cases, which include all those recorded up to that date, viz., 1873. He bases the paper on a most interesting case in which digital compression, perchloride of iron injections, and, finally, ligation of the common carotid was performed, with a completely satisfactory result. Among these cases he quotes the results of twelve post-mortem examinations.

In no case was there found a simple traumatic aneurism on the internal carotid.

In ten the lesion was situated behind the orbital cavity.

In three traumatic cases there was a direct communication between the artery and vein.

In one case there was found an aneurism of each ophthalmic artery.

In three "idiopathic cases" there was found a rupture of an aneurism of the internal carotid in the cavernous sinus.

In one case a simple dilatation of the artery.

In eight cases the ophthalmic veins were found enlarged and varicose.

He concluded from the post-mortem examinations that

(1) The most usual lesion found is a direct communication between the artery and vein.

(2) That no case was found due to a traumatic aneurism of the internal carotid.

He further points out how an aneurism of the internal carotid in the cavernous sinus may exist without any signs of intra-orbital aneurism. In support of this, he quotes a case of Mr. Holmes and a case of Mr. Jonathan Hutchinson's.

In the latter case, a woman aged forty years, had a circumscribed sacculated aneurism springing from the outer side of the left internal carotid in the cavernous sinus. The sinus appeared to be obliterated. There were no orbital signs except those due to pressure on the third, fourth, and fifth nerves.

In the *Lancet*, 1896, Vol. i, 1559, Mr. Rivington further makes the dogmatic statement, in reply to a paper published by Mr. Walker, *Lancet*, London, 1894, Vol. i, pages 191-193,—

(1) That true pulsating exophthalmos cannot be caused by a circumscribed or fusiform aneurism of the internal carotid.

(2) That the symptoms only appear if the artery ruptures and the blood enters the veins.

These opinions are also stated in Heath's "Surgical Dictionary" in 1886, though here he admits that a case quoted by Dr. Dempsey, of Belfast, in which an aneurism of the ophthalmic artery existed, modifies his conclusions somewhat.

The next important paper on this subject is by Professor Sattler, of Erlangen (Von Graefe and Soemish's *Handbuch der Augenheilkunde*). He collected 106 cases, including those of Mr. Rivington, and made a summary of the literature up to date, viz., 1887.

In four out of nineteen post-mortems, an arteriovenous aneurism was definitely found with tear of the artery in the cavernous sinus; his conclusions practically agree with those of Mr. Rivington.

An illustration of a dissection of an arteriovenous aneurism in the cavernous sinus appears in this article, the chief noticeable feature of which is the enormous dilatation of the ophthalmic veins.

Professor Leon le Fort, in the *Revue de Chirurgie*, 1890, p. 457, summarizes the results found in 100 cases.

In the traumatic cases he thinks that fracture of the base need not always exist as a cause of aneurism of the internal carotid. He is of opinion that the internal carotid in this region has a peculiar friability, which causes its coats to give way even after slight violence applied to the skull. This explanation might account for the aneurism found in our case

at the posterior part of the cavernous sinus. He considers that aneurism of the ophthalmic artery, aneurism of the carotid in the cavernous sinus, or rupture of the carotid into the sinus, give rise to almost identical symptoms.

As a means for diagnosis between the two latter conditions, he lays stress on two points.

(1) The existence of a "bruit de souffle" continuous with exacerbations is in favor of rupture of the artery, and that aneurism only gives rise to an intermittent bruit, Nélaton's sign.

(2) The pulsations in the former case are much more powerful than those in the latter; the direct flow of arterial blood into the veins causing a more marked result than a transmission simply of the systole and diastole of an aneurismal carotid.

He considers the commonest lesion to be rupture of the carotid artery in the cavernous sinus, and that the consequent abnormal development of the ophthalmic vein is the principal lesion and causes the chief symptoms. The results of eighteen post-mortem examinations of these cases are published in Norris and Oliver's "Hand-book of Diseases of the Eye," and as a result the following statements are made:

(1) In no single case of true aneurism of the internal carotid in the cavernous sinus were there found any signs of venous stasis exophthalmos nor pulsation during life.

(2) That most cases of pulsating exophthalmos consequent on extra-orbital lesions are due to rupture of the internal carotid into the cavernous sinus.

In the Middlemore lecture at Birmingham in 1898, Henry Eales attributes pulsating exophthalmos to an arteriovenous communication.

Ligature of Common Carotids.—The question of the advisability of ligature of the common carotid in these cases has well been a controversial one, as Mr. Barnard has pointed out. The treatment by ligature of a recent traumatic case differs widely from that of a long existing or idiopathic one.

In favor of the treatment by ligature, one can simply refer

to the numerous cases quoted in the literature in which this operation was performed with perfect results.

It is striking, also, to find how those who have contributed most largely to this subject are practically unanimous in its favor; *e.g.*, Mr. Rivington urges ligature of the common carotid in traumatic cases.

His figures are as follows: In 26 cases, 23 recovered, 14 were cured, 3 died.

In 44 cases, *i.e.*, idiopathic plus traumatic, the results were: 26 cases cured, 7 partial, 5 failures. In 17 vision was restored, in 3 the bruit persisted. Both carotids were tried in three cases.

He considers the operation is contraindicated in the very aged.

The return of symptoms after ligature he ascribes to

(1) Return of the flow on the same side due to deficient coagulation of the blood.

(2) The veins may close on the same side, but the blood reaches the other eye by the circular sinus.

(3) A fresh aneurism may appear in the opposite eye.

Professor Sattler says that ligature of the common carotid is *the* treatment for traumatic pulsating exophthalmos dependent on either of the three conditions previously mentioned.

Professor Le Fort is also strongly in favor of early ligature.

His statistics are as follows: Ligature of common carotids, 61 per cent. successful cases, 54 per cent. cured.

In compression of the common carotid 86 per cent. of cases were not improved. He goes farther, and says that if the exophthalmos is double, if the ligature on one side has failed, and if then pressure on the other side checks the pulsations and bruit, that one should not hesitate to tie the other carotid.

Henry Eales (*vide supra*) is of opinion that ligature of the common carotid is only indicated in the young, and in those whose life is seriously threatened. That in other cases ligature may be deferred because

(1) Cases have existed for years without hæmorrhage or any fatal symptom.

(2) There have been a few cases of spontaneous cure.

(3) Both carotids have been consecutively tied without success.

Mr. Walker, of Liverpool, in a paper in the *Lancet*, published 1894, p. 193, strongly urges early ligature of the carotid in these cases. The paper is based on the notes of two cases in which ligature was performed, the striking feature in one of these being the return of vision in the affected eye.

Mr. Walker is of opinion that in early cases, except in direct stabs and wounds from fragments of bone, the lesion is at the outset a traumatic aneurism of the internal carotid, and that in time this gives way and the blood enters the cavernous sinus.

Coggin, in *Archives Ophthalmic Society*, New York, 1883, p. 187, performed a post-mortem examination on a patient in whom ligature of common carotid was performed with subsequent hemiplegia and death.

He found the ophthalmic veins to be rather larger than usual, and a well-marked aneurismal dilatation of the cavernous portion of the internal carotid artery. The ligature was applied five weeks after receipt of injury, typical signs of pulsating exophthalmos were present.

The arguments quoted against the operative treatment for this condition are based upon

(1) The records of several cases in which physical signs and symptoms had existed for a prolonged period, with but little marked effect on the well-being of the patient or little danger to life.

The following very striking cases may be quoted as an example of this:

(a) Mr. Williamson, in *British Medical Journal*, 1894, Vol. ii, p. 806, showed a case in which the symptoms, bruit, venous dilatation, pulsation, etc., had lasted for twenty-three years. The lesion in this case was due to an injury to the head, with signs of fracture of the base of the skull.

(b) A case exhibited at the Ophthalmological Society by Mr. Adams Frost in 1882.

A man who twenty-eight years before had been run over by a wagon. Proptosis, pulsation, bruit, were present on both sides. No operative treatment had been attempted.

(c) In the *Ophthalmological Transactions*, Vol. ix, is a case reported by Adolph Brunnier.

Sixty-five years' duration, dating from an accident when twelve months old. There was marked proptosis and pulsation, well-marked bruit, no subjective noises, nor cerebral disturbances.

(2) The recurrence of symptoms and signs after ligation.

This is found to have taken place in many cases. The pathological condition in these had lasted for some time, months or years; and no doubt the failure was in every case due to the collateral circulation having been well established.

A case published by Knapp, *Archives of Ophthalmological Society*, New York, p. 201, is a good example of this.

Mr. B., New York, seven years before sustained an injury to the head which led to symptoms of arteriovenous aneurism. The common carotid was ligatured, but feeble pulsation was felt forty-eight hours later. The protrusion of the eye, which had at first subsided, returned markedly, and the eye had to be enucleated two years later.

Professor Sattler quotes similar cases in his table, viz., Morton's, Fotheringham's, and Hansen's.

Mr. Reeve, in the *Transactions of American Ophthalmic Society*, 1904, mentions a case of single pulsating traumatic exophthalmos in which both carotids were ligatured with an imperfect result.

The risks incurred by ligation of the common carotid.

These are (a) Sepsis. (b) Hæmorrhage, either immediate from slipping of the ligature or recurrent from ulceration of the vessel wall. (c) Cerebral complications and hemiplegia.

Sir John Erichsen, quoted in Jacobson's "Operations of Surgery," says that in 25 per cent. cerebral symptoms occur,

either early or remote. In the aged and in those subject to atheromatous disease the percentage will probably be much higher than this.

Coggin, in *Archives Ophthalmic Society*, New York, 1883, p. 187, quotes a case of a patient, aged sixty-six years, in whom hemiplegia and death followed ligature of left common carotid five weeks after injury. In this case, P.M., optic vein rather larger than usual; there was a marked aneurismal dilatation of the cavernous portion of the internal carotid artery.

The two cases mentioned in Rivington's paper who succumbed were aged sixty-three and sixty-five respectively.

(d) The occurrence of blindness in the corresponding eye after ligature is reported by Sigrist in *Archives Ophthalmic Society*, New York, 1898, p. 542.

(1) In a case of ligature of the carotid for cancer of the tongue, embolism of the central artery of the retina on the same side followed with consequent blindness.

(2) In a case of traumatic pulsating exophthalmos the external and internal carotids were tied simultaneously; central artery embolism followed.

(c) Homonymous hæmianopsia followed ligature in one case quoted by Axenfeld.

The following statistics of the results of ligation of the common carotid are published in Tillmann's "Text-Book of Surgery," Vol. ii, Chap. 10.

In 320 cases, 170 recovered and 132 proved fatal, a mortality of about 41 per cent.

Of these 132 cases, 78 were caused by cerebral affections.

In 23 cases, ligation of both common carotids were followed by five deaths,

W. Zimmerman (quoted by Tillmann) in 65 cases quotes a mortality of 31 per cent.; 26 per cent. of these showed brain symptoms.

Pilz and Friedlander (also quoted by Tillmann) give the mortality as 18 per cent. and 13 per cent. respectively.

Conclusion.—(1) That a traumatic sacculated aneurism

of the internal carotid in the cavernous sinus can give rise to the typical symptoms of pulsating exophthalmos.

(2) That this lesion can follow a head injury without being directly caused by basal fracture.

(3) That there is no evidence to prove that this condition does not always occur at first, and a communication with the veins is a later and secondary consequence.

(4) That the signs of pulsating exophthalmos are not necessarily due to the presence of arterial blood in the ophthalmic veins, and need not be dependent on excessive dilatation of these veins.

(5) That in young subjects and in traumatic cases seen early, ligation of the common carotid is the best treatment.