PULSATING EXOPHTHALMOS; SUCCESSIVE LIGATION OF BOTH COMMON CAROTID ARTERIES; DEATH.*

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Patient.—S. C., a strong, healthy-looking girl, 22 years of age, applied at the eye dispensary of the Jefferson Medical College Hospital July 30, 1903. She complained of pain in the left eye and left side of the head, and of a constant subjective noise.

History.—On the evening of July 3 she was struck on the inner angle of the right orbit, between the internal canthus and the nasal bone, by the handle of a heavy butcher knife, thrown from a distance of about 15 feet. Both lids of the right eye were bruised and slightly cut, and the nose bled, but other than these insignificant injuries she suffered no immediate ill effects. On the following day she noticed a noise in the head, which she referred more particularly to the left side. Two weeks later the left eye became prominent.

Examination.—At the time of the first examination proptosis was marked, pulsation of the eyeball was present, and a bruit was distinctly heard by applying a stethoscope to any part of the head, or over the large vessels on both sides of the neck, and louder over the closed lid of the left eye. It was diminished by pressure on the vessels of the neck. A distinct thrill was communicated to the finger, laid on the termination of the nasal artery on the nasal bone. A superficial vein in the outer half of the left upper lid was greatly dilated and tortuous and the lid was discolored and swollen. The eye was dislocated outward and downward. Movements in all directions were limited, particularly inward and upward, and diplopia was noticed in all parts of the binocular field. The sclera was deeply injected, the media clear, the pupil dilated and slowly reacting and the interior of the eye healthy. Tension normal. The pain in the orbit was constant and severe and increased by the recumbent position. The eyeball could easily be replaced in the orbit, but the exophthalmos returned immediately after the compression was relaxed.

September 3. L., pupil measure, 5 mm.; R., 3 mm. The left reacts sluggishly to light and accommodation, V. = 6/6, with correction of +3 D. There is no change in the appearance of the fundus; the optic papilla and the retinal and choroidal vessels remain perfectly normal. There was a slight systolic murmur over the apex of the heart.

Course of the Disease.—After observation in the out-patient department for several days, the symptoms increasing in severity, Miss C. was admitted to the hospital. She was put to bed, kept absolutely quiet, and free from all physical exertion, and given large doses of potassium iodid.

During this time Dr. W. W. Keen and Dr. S. S. Cohen confirmed my diagnosis of arteriovenous aneurism in the cavernous sinus. The eye became more prominent and less mobile, the veins of the lid more and more injected, the largest measuring 2-3 mm. in diameter, the noise and pain more unendurable in spite of treatment. Pulsation and bruit could be readily observed at the nasal side of the internal canthus, and with the stethoscope applied to the closed lids, a continuous pulsation with distinct increase in the sound with each contraction of the heart was heard. This bruit could be detected not only over the left eyeball and temple, but on the entire left neck, cheek and over the right eye and cheek, and at a point under the right jaw.

Urine.—Amber, 1,012, neutral, a trace of albumin. No sugar, urea 1.3 per cent., triple and amorphous phosphates, squamous and columnar epithelium, a few leucocytes and erythrocytes. No casts.

After a few days of rest and medical treatment she left the hospital, unimproved. She re-entered Sept. 24, 1903,

SURGICAL REPORT BY DR. KEEN.

I saw her again on September 25. I confirmed the observations made by Dr. Hansell, and agreed with him in the suggestion that the left carotid should be tied. Before this could be done, the exophthalmos had evidently increased and the vein in the upper lid was distinctly more pronounced and more tortuous. The thrill and bruit also were more marked than before.

Operation.—September 30. I ligated the carotid with silk on a level with the cricoid cartilage. I did not see the descendens noni nerve, the jugular vein, nor the pneumogastric nerve. Dr. Hansell examined the eye-ground by the ophthalmoscope as I tied the carotid. The instant that the ligature was tightened all the arteries faded so that they were invisible. Both he and I afterward examined for bruit and thrill and found both gone. At the time of the ligation of the artery also the blood pressure was observed, by the Riva Rocci apparatus. It rose 15 mm. and the rise was maintained after the operation.

Result.—Her temperature never rose above the normal and she made a perfect operative recovery in a few days. (The aneurismal bruit returned, so that it was perceived through the stethoscope as a faint continuous murmur at 4 p. m. on the day after the operation, 25 hours after the operation was concluded. The exophthalmos diminished greatly immediately after the operation, though the eyeball was still somewhat more prominent than the other, so that it was only moderately noticeable. She said she subjectively perceived the sound, but that it was very slight and far less annoying than it had been before the operation. She left the hospital Oct. 10, 1903.

She re-entered the hospital on November 8, on account of the recurrence of all her symptoms, especially the annoyance caused by the bruit. The exophthalmos, also was distinctly greater than when she left the hospital. Dr. Hansell observed for the first time, also, distinct retinal hemorrhages so that she was going from bad to worse, and the integrity of the eye was threatened. This forced us to a second operation immediately, though I had hoped not to tie the other carotid at all, or at least, to defer the ligature for several months, so as to allow of the establishment of the collateral circulation.

Second Operation.—November 11. In view of the retinal hemorrhages, increase of bruit and of the exophthalmos I ligated the right carotid, under local anesthesia, by a solution of adrenalin and eucaïn. The only time when she had the least pain was when I was separating the sternocleidomastoid from the tissues about it by blunt dissection, so as to expose the artery. The solution had not infiltrated so deeply as this. She expressed herself as much better satisfied with this method of anesthesia than with the ether. When I had sutured the wound, I was very much struck with the absolutely blanched appearance of the skin as a result of the adrenalin. It was a dead white over an area which extended above, below, and to a considerable distance both to right and left of the incision. At the moment of tightening the ligature, Dr. Hansell observed the eye ground of the right eye. The moment the ligature was tied, the arteries disappeared as before.

Result.—So far as the wound was concerned, it healed by primary union without any rise of temperature whatsoever. On the second day after the operation she showed a little drowsiness. This deepened and on the third day was very marked. That day, November 14, she had a series of convulsions during the afternoon and evening. On the 15th (the fourth day), she was paralyzed on the left side, and a number of convulsions occurred, becoming finally almost continuous. She died at 10:26 a. m., November 16. Dr. Hansell and I urgently requested a postmortem, and saw the family personally, but they absolutely refused it.

While there may be other causes for pulsating exophthalmos, rupture of the carotid artery in its passage through the cavernous sinus is stated by de Schweinitz to be the pathologic condition in about 60 per cent. of the 200 cases reported up to 1899. In the present case

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it is impossible in the absence of a postmortem to be absolutely certain that this was the condition, but it is probable for the following reasons: First, the pulsating exophthalmos; second, the continuous throbbing bruit which was markedly increased during systole and diminished, but did not disappear during diastole of the heart; this would seem to be the most important reason; third, the thrill which accompanies an arteriovenous aneurism; fourth, the passive enlargement of the veins.

I regretted extremely the necessity of ligating the opposite carotid so early as six weeks after the first ligature, for I greatly feared that the collateral intracranial circulation might not be well established, and that so early a ligation might prove fatal. The increasing retinal hemorrhages which threatened the integrity of the eye, however, compelled us to do the second operation.

Murray¹ reviews the subject of pulsating exophthalmos at some length. Seventy-one per cent. of the 197 cases reported up to 1898 followed traumatism, and 29 per cent. are due to existing chronic endarteritis of the internal carotid artery. In speaking of the therapeutics, he says that of 53 cases treated by digital compression, 15 were cured or improved; by ligature of the common carotid 51 per cent. were cured, 17 per cent. improved, 17 per cent. unimproved, 10 per cent. died. The mortality following the operation is only 10 per cent., while the death rate following the same operations for the cure of other conditions than pulsating exophthalmos is 25 per cent. (Wyeth gives 43 per cent. in 789 cases). He quotes Boden in reference to the frequency and mortality of double operation, who reported in 1899 that there had only been 6 cases of ligature of both common carotids, the interval between the two operations in 4 of the 6 cases being thirty days, fifty-four days, sixty days, thirty-two days. Five of the six patients were cured or improved, and none died.

The most recent compilation of the papers that have been published on the subject is that by Barnard and Rugby.² These writers report a case in which a bullet passed through the roof of the mouth to the base of the skull, which was perforated and smashed. The left side of the face was paralyzed and the left pupil was dilated and fixed. The lids were swollen and very prominent, all the external ocular muscles paralyzed, the cornea insensitive and the eye pulsed vigorously. A thrill was felt and a bruit heard over the closed lids. Ligature of the left common carotid artery was performed. The proptosis diminished and the pulsation disappeared for four days, recurred and disappeared again in ten days, but the eye was blind from opacity of the cornea. Two months later the patient complained of headache. The bullet, which was located by the x-rays above the petrous bone in the temporo-sphenoidal lobe, was probably surrounded by purulent degeneration of the cerebral matter. The postmortem showed the presence of a double sacculated aneurismal dilatation in the intracranial course of the internal carotid artery. There was no arteriovenous communication in the cavernous sinus. The interest in this case lies in the presence of all the typical signs of traumatic pulsating exophthalmos due to the unusual lesion of a sacculated aneurism of the carotid artery. The authors collate statistics both in favor of and against ligation

of the common carotid. Rivington³ in 44 cases, both idiopathic and traumatic claimed about 50 per cent. of cures. LeFort⁴ claimed 61 per cent. successful, of which 54 per cent. were cured. The results of compression are much less favorable, according to LeFort, who gives 86 per cent. of failures.

This author says: "If the exophthalmos is double and ligation on one side has failed, and if pressure on the other side checks pulsation and bruit, one should not hesitate to tie the other carotid." C. S. Bull⁵ says: "Ligation of the carotid is the oldest operation for the relief of pulsating exophthalmos, and has given the most satisfactory results. As a rule, the pulsation and bruit disappear immediately, any existing tumor collapses, the eye often sinks back into the orbit, and the tension and distension of the veins in the orbit diminish. Faint subjective sounds may return after a few hours, but the other symptoms soon entirely disappear. The swelling of the lids and the chemosis vanish, the exophthalmos lessens, the motility of the eyeball returns, and the vision is gradually restored. The swelling and cloudiness of the optic disc subside, the retinal veins become less engorged and tortuous and the hemorrhages are absorbed. Paresis of one or more of the ocular muscles sometimes remains for a long period unchanged. In most of the cases, the cure is complete in six weeks."

REMARKS.

The return of the affection after ligation may be due to deficient coagulation of blood, or the veins may close on the same side, but the blood finds its way to the other side through the circular sinus, or there may be a fresh aneurism, or the superior ophthalmic vein of the side first affected has been obliterated at its opening into the cavernous sinus by the thrombosis of the sinus produced by the ligation of the carotid. The cavernous sinus subsequently regains its permeability, and the still yielding cicatrix in the arterial wall yields and opens again. The arterial blood again enters the sinus, passes through the circular sinus into the cavernous sinus of the opposite side, and produces here the symptoms of pulsating exophthalmos.

As against ligation, it is urged that there are records of several cases in which the physical signs and symptoms had existed a long period with little marked effect on the well-being of the patient or little danger of death. Among them is a traumatic case by Williamson⁶ that had persisted twenty-three years; one by Frost,⁷ twenty-one years; one by Brown,⁸ sixty-five years.

As a second argument is the recurrence of the signs and symptoms after ligation, and as a third is the possibility of a spontaneous cure.⁹ Rivington's statements of postmortem findings in 12 cases are interesting. In no case was there simple traumatic aneurism; in 3 direct communication between the artery and vein in the cavernous sinus; in 1, aneurism of each ophthalmic artery; in 1 simple dilatation of the carotid artery; in 8, the ophthalmic veins enlarged and varicose. Up to 1898, 197 cases were published without settling the question of cause, course or treatment.

3. *Medico-Chirurgical Trans.*, 1875.

4. *Rev. de Chirurgie*, 1890.

5. *Norris and Oliver's System*.

6. *British Med. Jour.*, 1894.

7. *Ophthal. Soc. Great Britain*.

8. *Ophthal. Trans.*, vol. ix.

9. C. A. Silver: *New York Med. Jour.*, April 9, 1904.

1. *Annals of Surgery*, March, 1904.

2. *Ibid.*, May, 1904.