SATTLER (R.)

PULSATING PROPTOSIS AND ELASTIC TUMOR

OF

LEFT ORBIT

CONSEQUENT UPON A TRAUMA OF THE SKULL —LIGATION OF LEFT COMMON CAROTID

BY

ROBERT SATTLER, M.D.

OPHTHALMIC SURGEON TO THE CINCINNATI HOSPITAL, CINCINNATI, O.

Reprinted from THE MEDICAL RECORD, *June* 13 *and* 20, 1885

NEW YORK

TROW'S PRINTING AND BOOKBINDING CO.

201–213 EAST TWELFTH STREET

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PULSATING PROPTOSIS AND ELASTIC TUMOR OF LEFT ORBIT,

Consequent upon a Trauma of the Skull—Ligation of Left Common Carotid.

That rare lesion, of which abnormal prominence or proptosis and pulsation of the eyeball constitute the most conspicuous features, and which by earlier writers was described under a variety of names, is of interest to the surgeon principally, because numerous distinct pathological lesions have been discovered on post-mortem examination.

The list of names includes aneurism by anastomosis,[1] aneurism of the ophthalmic artery,[2] erectile tumor of the orbit,[3] rupture of an aneurismal dilatation into the cavernous sinus,[4] vascular protrusion of the globe,[5] pulsating tumor of orbit,[6] rupture of the internal carotid and arterio-venous communication within the cavernous sinus,[7] pulsating exophthalmus,[8] etc. If, however, the selection of a name has been difficult, for the reason that a uniform pathological alteration, either intra- or extra-orbital, was not upheld by the results disclosed in the fatal cases in which a post-mortem examination was practicable, the orbital lesion, with its traumatic or idiopathic-spontaneous origin, nevertheless remains an interesting and rare one.

The uniformity and prominence of the clinical features of this lesion are particularly conspicuous, and they constitute a most typical group of phenomena. It is,

[1] Travers: Med.-Chirurg. Trans., 1809, vol. ii., p. 1.

[2] Busk, quoted by W. Rivington: Med.-Chirurg. Trans., vol. lviii., p. 185. Morton: Amer. Jour. Med. Sciences, April, 1865. Gioppi: Annales d'Oculistiques, and for additional references, relating to Notes [3], [4], [5], [6], [7], [8], to the Chronological Résumé of cases appended to Mr. Rivington's article mentioned above.

therefore, not surprising that attempts should have been made from the earliest times to associate them with, and make them dependent upon, a definite pathological lesion. The earlier reported cases—1809 to 1850—were interpreted by the aid of the then current and most generally accepted theories. Pathological evidence was meagre and the results[9] from treatment (ligation of the common carotid) so uniformly successful that many speculative assertions were advanced, based only on clinical interpretation and a few pathological developments.

In this connection it is only necessary to refer to the views advanced by Travers,[10] Busk,[11] Nunnelly,[12] Morton,[13] Velpeau, and many others, and to note the modification of the names chosen, and the theories advanced, as pathological proofs accumulated.

If, however, the weight of pathological evidence of the earlier cases does not convincingly point to one, but on the contrary upholds a variety of distinct lesions, both intra- and extra-orbital, the results of more recent post-mortem examinations and the careful analysis of the non-fatal cases assigns to one lesion, rupture of the internal carotid within the cavernous sinus, a foremost consideration. In addition to anatomical proof it offers a most rational and plausible explanation for the clinical phenomena.

Those who first described this rare affection based their diagnosis on clinical interpretation alone, and it was upheld on purely speculative evidence. Only in exceptional instances was post-mortem examination practicable, and unfortunately in these cases (Guthrie,[14] Carron du Villards[15]) only meagre and untrustworthy

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[9] Pétrequin's was the first fatal case following ligation. It occurred in 1845, and was the first lethal termination among twelve cases which, with the exception of Roux's case, in which no effect was produced on the disease, all proved successful. No post-mortem examination was made in Pétrequin's case.

[10] Travers: Op. cit.

[11] Busk: Med.-Chir. Trans., vol. xxii., p. 124.

[12] Nunnelly: Med.-Chir. Trans., vol. xlii., pp. 168, 173, and vol. xlviii.

[13] Morton: Amer. Jour. Med. Sciences, 1865-1870.

[14] Guthrie: Operative Surgery on the Eye, 1823. p. 158.

[15] Carron du Villards, reference by Professor H. Sattler; Graefe and Saemisch: Handbuch der gesammten Augenheilkunde.

accounts concerning the clinical manifestations were offered. In Carron du Villards' case, discovered accidentally in the dissecting-room, nothing is known of the symptoms during life. The first cases which were accurately observed and reported, proved so uniformly successful, and yielded so promptly to the treatment instituted, *i.e.*, ligation of the common carotid artery, that the real causative pathological factor was not discovered, and, as already mentioned, only speculative assertions, based on favorite theories as to origin, cause, and nature of the lesion were advanced.

Travers reported the first authentic case in 1809; he chose to designate it aneurism by anastomosis. Doubtless the teachings and classical descriptions of this lesion, in other parts of the body, by Hunter, as suggested by Rivington[16] and other writers on this subject, induced him to select this name for the orbital affection. He was followed by other surgeons, who adhered to the same term. Guthrie observed a most interesting case and described it as one of aneurism by anastomosis. His patient died of some other disease, and no interference was resorted to to relieve the affection of the orbits. Post-mortem examination revealed a true aneurism of each ophthalmic artery. That this pathological discovery would modify the views of subsequent observers was to be foreseen, particularly as the interpretation of the more prominent symptoms appeared so much more rational with the acceptance of this lesion as the causative factor, and also for the reason that for the first time definite pathological evidence was furnished by at least one example. Accordingly, aneurism of the ophthalmic artery was regarded for a number of years as the most probable lesion, but cases were nevertheless described under the first term. In 1835 Baron[17] presented to the Anatomical Society of Paris a pathological specimen of rare interest. It was destined to, and in fact did, modify the until then accepted views. During the life of Baron's

[16] Rivington: Op. cit.

[17] Baron, quoted by Delens: De la communication de la carotide interne et du sinus caverneux. Paris, 1870.

patient, exophthalmus, varicosity of the orbital veins, loud bellows murmur, etc., had existed. The patient died of some intercurrent disease. On post-mortem examination an aneurismal dilatation of the internal carotid, which had ruptured into the cavernous sinus, was found. Gendrin[18] reported in 1841 a similar case observed in 1835, in which the same lesion was most probable, although not so conclusively demonstrated by the post-mortem. Two distinct lesions upheld by post-mortem evidence could now be offered as tangible proof to account for and explain the clinical features; in addition the hypothetical ones, aneurism by anastomosis, erectile tumor of the orbit, etc., also continued to maintain their claim.

Out of the entire list of one hundred and thirteen cases only three unquestionable cases of aneurism of the ophthalmic artery, two of these within the orbit and one near its origin from the carotid, have been verified by post-mortem examination. In two additional cases an aneurism appeared the most probable conclusion; in the first (Dudley [19]) it was intracranial, and in the second (Williams [20]) case it was orbital. Both cases recovered. Dudley ligated the common carotid, and Williams resorted to instrumental compression. This last case is not included in Mr. Rivington's or Professor H. Sattler's list of cases.

In 1855 Nélaton[21] met with an exceptional case. His patient, a young student, received a blow with an umbrella against the left orbit. Two months later, the wound having completely cicatrized and vision good on the left side, exophthalmus, ptosis, pulsation of the globe developed on the opposite or right side. Compression by means of a tourniquet and other measures were tried, but the patient succumbed to uncontrollable hemorrhage three months after the accident. Post-mortem examination revealed a fracture of the sphenoid and a rupture of the right internal carotid in the cavernous sinus produced by

[18] Gendrin: Reference by W. Rivington, p. 221, op. cit.
[19] Dudley: American Journal of the Medical Sciences, January, 1843.
[20] Williams, E.: Orbital Aneurismal Disease and Pulsating Exophthalmia. International Medical Congress, Philadelphia, 1876.
[21] Nélaton: Delens, Dr., op. cit.

a splinter of bone. In 1865 Nélaton observed another and similar case. A young girl was thrown from a wagon with resulting fracture of the skull. Marked exophthalmus, visible pulsation of globe, loud bruit existed eight months afterward. Digital compression of the carotid was first tried, but was ineffectual, and was followed by ligature of the common carotid artery. The patient died amidst symptoms of pyæmia. Post-mortem examination disclosed enormous dilatation of the ophthalmic veins, and a rupture 2 mm. in diameter of the internal carotid and communication with the cavernous sinus; a fracture of the sphenoid and a detached splinter of bone which had produced the rent.

The anatomical alterations found in these two cases, and in one reported by Hirschfeld[22] in 1858, again called attention to the remarkable case reported by Baron. During all these years this case was not appreciated in all its importance, or considered as possibly offering the most rational anatomical basis and explanation for this rare affection. In 1870 Delens, basing his deductions on a most careful and analytic study of the reported cases, and a review of the pathological proofs, again advanced and upheld the probable correctness of Baron's conclusions. He fortified and advanced the latter's views, and suggested in addition to arterio venous communication, arterial propulsion or direct forcing of the arterial current into the venous channels of the orbit.

Even though at present the pathological evidence, that arterio-venous communication and arterial propulsion constitute the real lesion, is not sufficiently numerous, convincing, or conclusive, it nevertheless rests upon a more secure anatomical basis than all the other lesions or imperfectly supported theories.

True aneurism of the ophthalmic artery,[23] spontaneous rupture of an aneurismal dilatation of the internal carotid within the cavernous sinus,[24] traumatic rupture of the internal carotid and arterio-venous communication between it and the cavernous sinus,[25] thrombosis of the

[22] Hirschfeld : Delens, Dr., op. cit.
[23] Guthrie, 1823 ; Carron du Villards, 1838 ; Nunnelly, 1858.
[24] Baron, 1835. [25] Nélaton, 1855.

cavernous and petrosal sinuses,[26] (?) and tumors of the orbit[27] are the pathological alterations verified and upheld by post-mortem examination. Aneurism by anastomosis, the favorite term selected by so many surgeons, has never been confirmed by post mortem examination.

Out of 113 cases described under various names, but all presenting to a greater or lesser degree the more conspicuous clinical symptoms, 26 fatal cases are recorded. Post-mortem examination was made in 19.

Unmistakable rupture or perforation of the internal carotid and communication with the cavernous sinus was discovered in four cases, all traumatic. The first is the celebrated case of Nélaton (1855), the second is Hirschfeld's (1858), the third is Nélaton's second (1865), and the fourth is Leber's case (1878). In these four instances post-mortem examination definitely established a rupture of the internal carotid within the sinus. In Nélaton's first case it was produced by a splinter of bone and fracture of the sphenoid, etc. The artery was extensively ruptured and torn transversely. In Hirschfeld's patient, an old woman, a small circular rupture was found in the internal carotid. Nélaton's second case was equally conclusive; a splinter of bone was found driven through the wall of the sinus into the internal carotid. Leber's case showed marked dilatation of the internal carotid and several small openings communicating with the sinus.

Spontaneous rupture of an aneurismal dilatation of the internal carotid was first described, and the pathological specimen produced as proof, by Baron in 1835. A second case was observed by Gendrin in the same year, but reported six years later, in which a similar lesion was probable, though not so conclusively demonstrated. A third case was described by Nunnelly; death occurred on the sixteenth day following ligation.

For more complete reference to this case I must refer to Nunnelly's[28] description, and for additional and exhaustive information, to the excellent and complete

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[26] Bowman-Hulke, 1858.
[27] Nunnelly, 1863; Critchett, 1854; von Oettingen, 1873.
[28] Ibid: Op. cit.

monographs by Mr. Rivington[29] and Professor H. Sattler.[30] The latter is a German authority upon this interesting subject, and the author of a most exhaustive and analytic article, containing a tabulated statement of one hundred and six cases. In either one will be found an accurate compilation of the reported cases and also a most thorough review of the prominent symptoms and special features of interest of the more remarkable cases.[31]

In five additional fatal cases arterio-venous communication was most probable, even though it was not definitely established by the post-mortem examination which was made in every case. These five include Blessig's interesting case, in which a dilatation of the internal carotid within the cavernous sinus was found; a perforation of its wall could not, however, be demonstrated. De Wecker and Richet's case may also be considered one of arterio-venous communication; the rent in the artery so small, however, that it was overlooked. Bowman's case, reported by Hulke, is replete with interest. No arterial lesion was found, but extensive thrombosis of the cavernous circular and transverse sinuses existed. This case elicited much discussion. In one of Morton's cases the post-mortem examination was made under great difficulties. It is stated that great dilatation and plugging of the cavernous and circular sinuses was found, but no arterial lesion. The fifth, observed by Von Oettingen, is interesting because the pulsating exophthalmus disappeared, either spontaneously or as the result of local deple-

[29] Rivington: Op. cit.

[30] Sattler, Professor H.: Pulsierender Exophthalmus. Graefe and Saemisch: Handbuch der gesammten Augenheilkunde.

[31] W. Rivington, p. 218, op. cit., refers to a remarkable case of Mr. Holmes'. His patient, a boy, aged sixteen, died of heart disease; at the post-mortem examination aneurism of the left internal carotid artery about the size of a small nut, filled with laminated coagulum, was found at the anterior part of the cavernous sinus. The third, fourth, and fifth nerves were stretched by the tumor. During life the orbital symptoms had been ptosis, dilated and fixed pupils, diplopia, impaired vision, and uncertainty in the movements of the eyeball. [Mr. Hutchinson communicated to the Clinical Society, after this paper had been read, a most interesting case of a circumscribed sacculated aneurism springing from the outer side of the left internal carotid artery in the cavernous sinus, and communicating with the carotid by a small aperture. The patient was a female, forty years of age. The tumor was as large as a pigeon's egg, and occupied the middle fossa of the skull. It appeared to have obliterated the cavernous sinus. There had been no orbital symptoms during life, except those due to pressure on the third, fourth, and fifth nerves (Lancet, April 17, 1875).]

tion, compress bandage, and digital compression. Two years afterward the patient died. The orbital lesion was supposed to have been due to a thrombosis or partial obliteration of the ophthalmic veins, and traces of a localized inflammation of the periosteum and retro-bulbar cellular tissue were found.

True aneurism of the ophthalmic artery was found in three cases—in Guthrie's and Carron du Villards' cases within the orbit, and in Nunnelly's at or near its origin from the carotid.

A tumor of the orbit was found in three cases. In Nunnelly's and Lenoir's cases it was malignant; in Oettingen's it was fibrous.

To the large list of so-called "pulsating cancer of the orbit," Critchett, Nunnelly, Halstead, Mott, Van Buren, Hamilton, and others cited in Noyes' article,[32] I can add another case. In 1880, a boy was brought to my clinic with exophthalmus and the existence of an elastic and soft projection at the inferior margin of the orbit. The tumor was elastic, and could, with pressure, be made to recede; no bruit was heard, but distinct pulsation was felt over the tumor. Compression of the carotid arrested it. The existence of this symptom made the diagnosis of pulsating angioma tenable; but the future rapid progress of the growth, and with it disappearance of the pulsation, dispelled all doubt concerning its nature. I removed the tumor, a myeloid sarcoma, without sacrificing the globe. For several months no return was noticed, and then followed a most rapid increase. Complete extirpation of the orbital contents and the use of the thermo-cautery accomplished a brief interval, but renewed activity soon followed and the boy succumbed, secondary manifestations occurring in the brain, the bones, and other organs.

Accepting, then, as the most probable lesion—rupture, large or small, traumatic or spontaneous—of the internal carotid, communication with and arterial propulsion into the cavernous sinus and its tributaries, the following con-

[32] Noyes, quoted by Mr. Rivington, p. 230, op. cit., and New York Medical Journal, 1869.

comitant conditions and symptoms may be considered manifest phenomena :

1. As a result of the rupture, a direct propulsion of the arterial column into the sinus, depending in volume and force on the dimensions of the rent, will occur ; this will also bring about an interruption in the physiological current or afferent function of this principal venous channel and its tributaries. This again entails interference and impediment, and may result in complete suspension and even a reflux or forcing back of the venous currents. The veins are transformed into distended, tortuous, pulsating channels, with dilated fusiform, glove-finger-like prominences in the anterior portion of the orbit, at points where the palpebral veins pass through the septum orbitale into the larger divisions of the ophthalmic veins.[33] These pulsating, smooth, elastic prominences[34] are therefore found just beneath the margin of the orbit, notably in the upper and inner region, and in some cases they even project beyond it. In many instances visible pulsation exists ; in others a simple stretching of the skin toward the nasal or temporal side renders it visible. On palpation a distinct impulse is communicated to the finger. Its force will vary : in the majority of cases it is strong, and again in others it is very feeble.[35] It will be influenced by physical exertion and the existence of a cardiac lesion. Localized absorption of the bony margin in consequence of the forcible pulsation is not an infrequent occurrence. In Brainard's case, 1851, reported in *The Lancet*, 1853, vol. ii., p. 102, it was pronounced. In the present case,

[33] Aubry in 1853 reported an interesting case, and to him belongs the credit of having established that the orbital veins may be transformed into pulsating channels. His patient, a woman, died suddenly after admission to the hospital. The post-mortem examination revealed no arterial lesion, but great enlargement of the ophthalmic veins. They and their terminal tributaries had formed the elastic vascular pulsating tumors. The cavernous sinus was enormously dilated, and communicated freely with the varicose ophthalmic veins, and terminated behind in a cul-de-sac, the communication with the inferior petrosal being cut off.

[34] A reference to the traumatic cases compiled in W. Rivington's paper and the tabulated list of Professor H. Sattler will afford abundant illustration of this prominent symptom.

[35] Compare case reported by W. Adams Frost, Pulsating Exophthalmus with Observations, Transactions of the Ophthalmic Society of the United Kingdom. "In the left orbit the swellings were soft and compressible and pulsated in a gently distensile manner. On the right side a globular swelling larger than a pea ; it was soft and reducible and pulsated feebly."

it had unmistakably resulted, but was not very pronounced.

2. The obstruction, arrest, or reflux to the flow of blood from the orbit through the cavernous sinus, causing, as already mentioned, distention and the pulsating bossy protuberances of the larger tributaries, the ophthalmic, superior and inferior veins, must also sooner or later result in dilatation and tortuosity of the tributary veins of the latter, which collect the blood from the terminal venous territories of the palpebral area. The veins comprising the terminal superficial territories become tortuous and dilated, with a distention and mound-like elevation of the entire palpebral area, which may extend also into the adjoining temporal, frontal, and nasal regions. This is typically indicative of obstruction situated in the ophthalmic veins or cavernous sinus. It is only in part due to the proptosis; its real explanation is the distention of the terminal venous ramifications. The upper lid is its principal seat; the skin presents a dusky red appearance, traversed by prominent and tortuous veins. The superficial veins may become so prominent that feeble pulsation and a distinct thrill or purr can be discovered on palpation.

3. The same cause, obstruction to the exit of blood from the orbit, also causes another typical symptom—proptosis and spontaneous and visible or easily producible pulsation of the prominent globe. In many cases the pulsation of the eyeball can only be detected by pressing the fingers over the closed lid; even slight pressure will discover a more or less forcible impulse.

4. Additional results from the same cause are disturbances of the intra-ocular circulation and impairment or suspension of function of the eye, paralytic phenomena of the motor and sensory nerves of the eye and appendages.

In this review of the pathological evidence in support of rupture of the internal carotid, etc., it is interesting to note the strongly corroborative proof offered by the clinical histories of many of the fatal and successful traumatic cases. From the preceding analysis of the anatomical alterations the clinical characters of this lesion are readily

deducible. I include in this brief review of the clinical features only the traumatic cases on record. The symptoms follow in the order of prominence and frequency, as illustrated by the published cases and the special prominent features existing in the case which forms the subject of this article.

A. Mound-like elevation of the palpebral area invading also the temporal, nasal, and frontal regions, associated with the following symptoms:

1, Increase in the thickness of the lid, due to vascular engorgement; 2, reduction of the muscular excursion of the upper lid; 3, dusky, cyanotic appearance of the skin; 4, tortuosity and distention of the cutaneous and subcutaneous veins; 5, prominent tortuosity of terminal cutaneous veins, notably the branches accompanying the ramifications of the naso-ciliary and angular arteries; 6, palpation may discover a feeble pulsation and the characteristic purr or thrill in these veins; 7, injection of the ocular and palpebral conjunctiva; 8, chemosis—particularly where the obstruction to the return of the venous blood is sudden is this symptom one of prominence and importance; 9, disturbance of the muscular apparatus of the iris, sluggish pupillary movement, myosis, mydriasis; 10, interference with the intra-ocular circulation, resulting in congestion of the choroid, œdema of the retina, pulsation and distention of the retinal veins, papillitis, neuro-retinitis, etc., with their resulting complete or partial suspension of function of the eye; 11, paresis or paralysis of the motor and sensory nerves of the eye and its surroundings; 12, various other symptoms referable to the affected orbital area not necessarily consequent upon it, but directly resulting from the primary or causative lesion, fracture of the basis cranii.

B. Pulsating elastic tumors or prominences in the anterior portion of the orbit, varying in number, shape, dimension, and locality.

1, The upper and inner portion of the orbital opening, between the globe and the bony margin of the orbit, the most frequent locality—they may also be situated above or outward and downward; 2, these "bossy protuber-

ances" often pulsate visibly, in others a simple stretching of the overlying skin is necessary to render them so; 3, palpation discovers a more or less forcible impulse; 4, pressure with the finger against these elastic tumors involutes the glove-finger-like apex, but does not arrest the pulsation; 5, arrest of pulsation can only be accomplished by compression of the common carotid, but even this in some cases only results in a temporary cessation, which after some time gives way to a feeble pulsation; ligation controls it more thoroughly, but it also may fail to arrest it, and other measures—galvano-puncture, injection of irritants, and ligation of opposite carotid—may prove necessary.

C. Proptosis or displacement and pulsation of the globe. In many cases the protruded eyeball is the seat of distinct rhythmical pulsations. If it is not visible it can be readily discovered on palpation.

1, The impulse, on palpation, is generally strong; 2, the firmest pressure against the closed lids and globe does not arrest it; 3, compression of the carotid at once controls it; in some cases it is only a temporary control and compression of the opposite carotid is necessary to effect a complete cessation. This also applies to ligation; 4, it is probable that the heavy upper lid exerts a controlling or compensatory pressure against the globe and guards against *excessive prominence.*

In the present case this was illustrated. When the palpebral fissure was opened with the thumb and index-finger, the pulsating globe advanced at once into the lid-opening and became so prominent, that it could be easily strangulated by the lids.

D. Subjective symptoms.

1, Discomfort, feeling of fulness, pain, resulting from the prominent globe and vascular engorgement of palpebral area; 2, disturbances of vision, either in consequence of the pendent lid or paresis or paralysis of the levator palpebræ superioris; 3, diplopia, due to paresis or paralysis of the extrinsic muscles; 4, defects of vision from disturbance of the retinal and choroidal circulation, etc., paralysis of accommodation; 5, existence of noises in the

head, referred to the affected orbit and also to different and remote parts of the head ; 6, these sounds vary in loudness, intensity of impulse, pitch and duration. Rarely does the patient speak of one sound, but in most instances refers to several. He may designate one as the principal or loudest sound and characterize it as beating, throbbing, or blowing, and compare it with the noise made by the escape-pipe of an engine (a most frequent comparison), and similar characteristics may be assigned to the other sounds. Particularly does the mewing, cooing, or moaning attribute of one sound, called by the French the bruit de piaulement or miaulement deserve mention. In the present case it had a moaning or distant vibratory cooing sound, and corresponded to the third bruit.

E. Corroborative proofs offered by the analytic interpretation of the subjective phenomena, aided by test of vision and functional examination of the eye and physical examination of the head and orbit.

1. Palpation detects increase or decrease of the orbital tension. In most cases the orbital tension is increased ; position of the head and posture of body influence it ; digital compression of the carotid increases it markedly. In the present case the orbital tension was pronounced in the standing, greater in the recumbent position, and greatly increased when the carotid was compressed. 2. It also discloses the force of impulse and its rhythm and duration in the pulsating tumors and eyeball. 3. Auscultation analyzes the special characteristics of the sounds and localizes their intensity, etc.

I report the following case because it offers, in my opinion, satisfactory clinical evidence for the existence of this lesion, upheld by the preceding pathological and clinical analysis and first accurately described by Dr. Delens ; the latter's views, supported by Mr. Rivington in an excellent paper, and fortified and enlarged by the addition of a most careful compilation and deductive reasoning, based upon all cases on record, by Professor H. Sattler.

It is, of course, admitted that clinical evidence can only be considered corroborative ; upon it alone a diag-

nosis of a lesion, particularly one with such an obscurity of origin, cannot be upheld. It therefore can only be considered problematic; yet the more thoroughly the clinical phenomena of a case are found to correspond with and resemble those existing in the isolated fatal cases in which post-mortem examination was possible, can they be regarded with greater probability as constituting the manifest and correlated phenomena of this pathological lesion.

About two years ago, G. P——, aged eighteen, a coal-miner, while at work in a coal-shaft, sustained a serious injury of the head. It was caught and crushed between two loaded cars. He was found and removed in an unconscious condition, bleeding profusely from both ears and nose. In about three days he regained consciousness, replied to questions, and at once remarked that his sight and hearing were defective. He also complained of great prostration and impairment of sensation in the extremities, but no paralytic symptoms existed, and his intellect was unimpaired.

The sanguinolent discharge from the ears continued about five days, then ceased in the left and changed to a purulent discharge in the right ear; this continued for five or six weeks and was attended by marked deafness.

No marked contusion or ecchymosis of the scalp or face existed immediately after the accident.

On the ninth day he had so far recovered that he was able to walk about. His chief complaint at this time was defective vision, diplopia, vertigo, and deafness. The deafness was so pronounced that he could not understand very loud conversation.

These symptoms lasted about five weeks and were followed by gradual improvement of hearing and vision, but vertigo, tinnitus, and peculiar humming sounds in the head continued and at times were greatly increased.

At this time, five weeks after the accident, he determined to seek the advice of a physician in Richmond, Va., to obtain, if possible, relief from the diplopia, deafness, and noises in the head. He is confident that at

this time no perceptible prominence of the eye existed, but he distinctly mentions a peculiar interrupted cooing or beating sound which he could not localize, but which differed from the continuous ringing sound referable to his ears, notably the right one. Two months after the accident he noticed, but whether sudden or gradual, or whether accompanied by a sudden noise or snapping sound in the head he cannot remember, a fulness of the left palpebral area and protrusion of the globe, together with a pulsating or throbbing sensation in the orbit. The sight of the left eye at this time was more impaired.

In the course of several weeks the noises in the head increased in intensity and assumed distinct characteristics, so that he was able to distinguish three distinct sounds.

The first and loudest was the bruit, which another person could hear by placing the ear over the closed lids of the left eye, or over the left temporal region; it was loudest and resembled the exhaust of a steamboat; the second, next loudest, was something like the first, but much weaker and of higher pitch; this was followed by the third sound, which he compares to the sound made by a wagon, loaded with iron, passing down the street. This third sound was cut short by the first sound beginning again.

By placing his finger over the closed eyelids, he could feel the pulsation of the globe; he could also, by pressure, cause the prominent eye to recede a little.

The protrusion of the globe continued to increase, and, in addition, a livid appearance of the palpebral area, together with a tortuous and distended appearance of the superficial veins of the globe and eyelids, developed. The noises in the head and the discomfort and vertigo attending all prolonged physical exertion forced him to abandon his work, and he determined to seek the advice of Dr. E. Williams, of this city.

Stat. præs.—Strong and muscular young man; no irregularity, prominence, or depression of head; the entire left palpebral area is the seat of an elastic swelling which extends and invades also the frontal and temporal regions; the skin is livid and discolored; numerous large

and small veins traverse this entire swelling; near the inner canthus the distention and tortuosity is greatest; several large varicose veins extend across the superciliary and nasal regions to the opposite side. Placing the finger over these distended vessels, a distinct thrill or purr is felt. Stretching the skin toward the temporal side, a distinct pulsation occupying the inner and upper portion of the orbital opening is seen; if rendered more tense, pulsation of the globe is also observed. On palpation a most forcible impulse is communicated to the finger, and a fusiform or glove-finger-like elastic projection is discovered immediately underneath the inner and upper orbital margin. Pressure against this smooth and elastic projection involutes the flattened apex, but does not arrest the pulsation. Compression of the common carotid at once arrests it.

The upper lid droops and the palpebral fissure is smaller. The action of the levator is not, however, suspended, but only interfered with by the increase in the thickness of the lid and contents of the orbit.

The ocular and palpebral conjunctiva are traversed by numerous large and tortuous veins. The cornea is clear, iris brilliant, pupil dilated and sluggish. V. = 0.4.

Ophthalmoscopic examination.—Media clear; intense congestion of disk, and tortuosity and distention of retinal veins. The disk and adjoining retinal regions present an intensely livid and œdematous appearance. Pulsation of the veins exists and is rendered more forcible by slight pressure against the globe.

No pathological alterations of the fundus oculi, however, are discoverable.

On opening the lids with thumb and index-finger, the globe at once advances into the palpebral fissure and distinct rhythmical impulse or pulsation is seen and felt.

Proptosis, or an advance of the globe forward, downward, and a little inward, of about three-fourths of an inch exists.

Pressure against the closed lids encounters a forcible pulsation of the globe and also of the elastic projection inward, but the pulsation cannot be arrested; it does,

however, effect a slight recession of the prominent eyeball. It is so painful that it cannot be long endured. Compression of the carotid at once arrests the pulsation of the eye and also of the elastic projection; it also permits a more complete reduction of the proptosis.

Complete paralysis of the abducens exists in both eyes. The secondary contraction of the internus is very pronounced, particularly in the left eye. Here the contraction is so marked, and the displaced globe is so markedly rotated around a vertical axis, that the equator almost presents and corresponds with the vertical meridian of the orbital opening. The excursions of the other muscles of the left eye are restricted but not inhibited; most marked is this of the superior rectus.

Auscultation over the closed lids, temporal, frontal, or parietal region, at once discovers several bruits.

The loudest is a forcible blowing sound synchronous with the heart's systole; it is followed by a similar sound, more prolonged, of higher pitch, and of less force; this merges into the third, a peculiar piping, at times vibratory sound, which is cut short by the first again beginning. These sounds have their intensity over the left orbital opening, brow, and temporal region, but can be heard over the parietal and occipital bones on both sides of the head.

Compression of the common carotid temporarily arrests all three sounds. After some time, however, the first sound reappears, very faint, and has the piping characteristic of the third sound; the second and third, however, do not return. By firm compression of the distended vessels traversing the left side of the nose and inner canthus this partial return of the first sound can be arrested; more effectually, however, is this accomplished by compression of the right common carotid.

These noises are all influenced by mental excitement and physical exertion.

With the exception of the ears, which both show the evidence of suppurative inflammation of the middle ear, retraction, opacity, cicatricial alterations, etc., and a small perforation of the right membrana tympani, the

probable consequences of a rupture of the membrana tympani, etc., or fracture at the base, no other symptoms indicative of fracture of the cranium or injury to the cerebro-spinal system exist.

To test the influence of rest and arterial sedatives, the patient was kept quiet and veratrum viride, aconite, digitalis, etc., administered in increasing doses. No perceptible influence, however, was exerted on the orbital lesion.

Digital compression, kept up by relays of students, was next tried; this was so painful and became so unbearable that instrumental compression was substituted. Digital compression was kept up about fourteen hours, followed by instrumental compression for about eight hours.

The patient then complained of vertigo and became very pale, and the ear became very cold.

This was followed again by arterial sedatives, compression of the facial and branches of the naso-ciliary arteries, but no change or modification of the symptoms was brought about.[36]

The inefficacy of these measures thoroughly established, ligation of the carotid was determined upon and approved of by Dr. E. Williams and Dr. L. C. Ayres. The case was then submitted for consultation to my friends, Drs. P. S. Conner, Thomas Kearney, and N. P. Danbridge, who all three pronounced in favor of ligation.

On January 12, 1884, I ligated the left common carotid, above the omo-hyoid muscle, without mishap or complication.

The following are brief extracts from the copious notes

[36] Several days preceding the operation I made a physical examination of the chest, with special reference to the heart-sounds. Marked pulsation of the external jugular veins and also of all the superficial veins of the neck on both sides existed. In addition a forcible pulsation over the sterno-clavicular notch and a widely diffused pulsation over the second intercostal space on the left side was also noticed, and on auscultation a systolic bruit, with its intensity over the pulmonary orifice, was discovered. An intrathoracic aneurism was suspected, and Drs. J. C. Mackenzie and Keyt were asked to make a more thorough examination. This was kindly done and the careful and accurate sphygmographic tracings taken by Dr. Keyt did not uphold the existence of intrathoracic aneurism; the latter looked upon the existing physical signs as the manifestations of a congenital anomaly of the right side of the heart. To both gentlemen I am indebted or their careful examination, which greatly modified my fears as to the final outfome of the proposed operative interference.

made by C. R. Holmes concerning the progress of the case during and after the operation:

"Took ether well; pulse full and strong; vomited several times during first part of operation. Anterior jugular was enlarged and crossed obliquely the superior carotid triangle.

"The sheath was reached and the ligature needle, bearing a double No. 2 McFarlan & Co. catgut, prepared according to Lister, was passed without much difficulty around the artery, and tied and cut off short.

"It was used double, because no heavier gut could be procured in time for the operation. The deep fascia were brought together by means of two catgut sutures, and six to close the wound of the superficial structures. During the first hour following the operation he vomited five or six times.

"Twenty minutes after the operation the proptosis and fulness of the palpebral area had greatly diminished; with the diminution of the prominence there was also complete disappearance of all noises and pulsation. This was noticed as an immediate result following the tightening of the ligature.

"At 10 P.M.: Pulse, 120; temperature, 99¾°. Gave one-fourth grain morphia hypodermically. At 3 A.M. the morphia was repeated on account of pain in the wound. Faint bruit reappeared, but no pulsation.

"January 13th.—Pulse, 132; temperature, 102°. Gave tinct. aconite, gtt. ij., tinct. belladonnæ, gtt. v., every four hours.

"Proptosis diminishing; no pulsation; bruit unmistakably heard. It is altered in pitch and character and is not always audible to the patient. It is reduced in intensity and quality and resembles more a cooing sound. The engorged and tortuous palpebral veins have disappeared. Proptosis much less; left cornea about on a level with right one. Difference in temperature between the two sides of the face less marked to-day; the left is, however, perceptibly cooler. Face has lost extreme pallor which existed for hours after the operation. Fre-

quent paroxysms of perspiration on brow and nasal region of left side. Wound doing well.

"January 14th.—Very restless during the night. Pulse fluctuating between 106 and 110; temperature, 101⅘° and 102°. Gave morphia hypodermically, gr. ¼, twice during the night and continued aconite, etc.

"Knuckle-like prominence less pointed; orbital tension altered; more and greater resistance on palpation.

"Bruit about same. Mind clear. Some swelling about wound and slight discharge.

"January 15th and 16th.—The bruit has diminished; orbital tension remains increased. Diffused redness and swelling about wound extending into clavicular regions; simple iodoform dressing continued.

"January 17th.—Slight return of pulsation, but the same distant, almost continuous cooing character of bruit continues. Position influences the pulsation; lying on the left side increases it.

"A slight purr or crepitation feeling is also discovered on applying the finger to the veins on the left side of the nasal region; pressure, however, over inner region of inner canthus or median line of brow causes it to disappear; it also brings about, not immediately, but after about three minutes of continued pressure, a cessation of the bruit. Had headache for several hours on leftside. Pulse, 96; temperature, 99⅕°; respiration, 20.

"January 18th.—Wound discharging, but no unfavorable local alterations. Patient says that he has heard the noise less to-day than at any time since the operation. The pulsation continues, but is very feeble. The fulness of the palpebral area is perhaps a little more pronounced; the proptosis, however, is not.

"January 19th.—Was permitted to sit up. No vertigo and absence of all unfavorable symptoms."

Five weeks after the operation the patient was discharged. At this time the following points were noted: Almost complete reduction of the proptosis. Inability to produce pulsation of the globe. Marked improvement of sight, V = 0.9 with −0.75 Sph. Diminution of the dis-

tressing noises and absence of the feeling of distention and discomfort about the orbit.

Perceptible fulness of the palpebral area, and a feeble pulsation of the elastic tumor, which is altered in shape and reduced in size, still exists. On auscultation, over the closed lids, a bruit, resembling a distant cooing sound, is heard ; it is a prolonged sound gradually increasing and diminishing in intensity, and is not associated with other sounds. The patient states that he hears but one sound, which resembles a cooing in the distance ; it is influenced by position and is greatest in the recumbent posture.

Pressure at the inner and upper portion of the roof of the orbit arrests, not immediately, but after several minutes of firm pressure, the pulsation of the elastic tumor, and also reduces the intensity of the bruit. It cannot, however, be made to disappear entirely by pressure in this locality. Compression of the right carotid at once arrests pulsation of the tumor and also the bruit.

The wound did not heal throughout by first intention ; a mild suppurative process involving lower portion was set up.

The short catgut ligature resorted to by Lister, Maunder, and other surgeons was employed. I was prompted to resort to it in this case, however, more particularly from personal observation of Dr. E. Gruening's successful case,[37] assisting him at the operation, and witnessing the immediate and remote results. This case deserves a most careful perusal, as many of its clinical features were phenomenal. It was a brilliant achievement of diagnosis, but even more conspicuous for the immediate, complete, and lasting success of the surgical interference proposed and instituted by Dr. Gruening.

May 27, 1884.—Patient returned, willing to submit to further treatment, if so advised. The proptosis had remained reduced, the elastic tumor pulsated, but not forcibly ; the fulness of the lid-area was perhaps a little more pronounced, but the cutaneous surface did not present that dusky cyanotic appearance, although the

[37] Gruening, E.: Archives of Ophthalmology and Otology, 1875.

superficial veins near the inner canthus were still prominent and tortuous. A thrill or purr in these prominent vessels could not be discovered.

The patient stated that he had resumed his work in the coal-shaft and had succeeded fairly well. He had not experienced the discomfort and pain which invariably developed, after even moderate physical exertion, before the operation. In referring to the distressing noises, he mentioned that the "exhaust sound" had entirely disappeared; the sound of "iron rattling" was only heard now and then, when up and about, but was always present and distinctly heard whenever he lies down. The cooing sound has grown less and less; to-day, although he has travelled several hundred miles and is exhausted, he has not heard it constantly. On auscultation, the same piping-cooing sound is heard, and at times presents a vibratory characteristic. It is probable that the patient does not hear two distinct sounds, but it is simply an alteration in the pitch, intensity, and rhythm of one sound, which is influenced and modified by position of the body.

The sight of the left eye is normal, with —0.75 Sph., and is better than that of the right. Under these circumstances, I did not consider further surgical treatment justifiable or specially indicated, and although the patient had come with the intention to have the right carotid ligated or to have the elastic tumor injected with an irritant solution, or have galvano-puncture resorted to, further interference, so long as the existing favorable conditions remained, was advised against.