

REFLECTIONS
ON THE
PATHOLOGY OF THE BRAIN.

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PART II.

(*Read 20th March 1822.*)

IN the course of those reflections on the pathology of the brain, which I had the honour to lay before the Society at our meeting on the 6th February, I endeavoured to shew, that there are natural obstacles to the free depletion of the brain, which have no existence in any other part of the system;—that we cannot, in fact, lessen, to any considerable extent, the quantity of blood within the cranium by arteriotomy or venesection;—and that when, by profuse hæmorrhagies, destructive of life, we do succeed in draining the vessels within the head of any sensible portion of red blood, there is commonly found an equivalent to this spoliation in the increased circulation or effusion of serum, serving to maintain the plenitude of the cranium.

If this be the peculiar condition of the brain, and if the obstacle to the free depletion of its vessels depend mainly on the cerebral system being defended from the weight and pressure of the atmosphere by the solid and unyielding cranium, it seemed probable, that, by removing a portion of the skull, and allowing the atmosphere to gravitate upon the brain, we should succeed in producing a much greater depletion of its vessels by general bloodletting than can be otherwise effected.

To ascertain this point, a portion of the cranium of a dog was removed by the trephine. The dura mater was wounded by the saw, and blood flowed from the surface of the brain. The brain was observed to rise and fall alternately, but so as always to fill the cranium; so that the rise was a sort of protrusion through the opening which had been made. One of the carotid arteries was opened, and in a minute or two afterwards there was an evident gradual sinking of the brain from the margin of the opening. While the blood yet flowed from the carotid, the animal was suspended by the ears, with the view of producing the greatest possible depletion of the vessels of the brain, and allowed to remain in this posture for three hours after death. The brain was sensibly depressed below the cranium, and a space left, which was found capable of containing a tea-spoonful of water. On removing the upper portion of the cranium, the brain appeared of diminished size, or shrunk in its dimensions, so that the membranes, instead of be-

ing stretched, seemed loosely extended over it shrivelled-like and unfilled. The membranes and the brain itself were pale and bloodless. No blood was found in any of the sinuses, except at the very terminations of the lateral, at the basis of the cranium. The vessels of the pia mater ramifying between the convolutions of the brain were shrunk, and dwindled to the size of small threads. The choroid plexus was also bloodless, and about a drachm and a half of serum was found effused at the basis of the skull.

Another dog was trepanned with more care, so that a circular portion of bone was removed without wounding the dura mater, which was separated from its adhesion to the cranium for some way round the margin of the opening, by means of a blunt instrument introduced for that purpose. The animal was then bled to death by opening at once the carotid and jugular of one side, suspended by the ears as the former, and examined three hours after death. The brain did not appear so much shrunk within the cranium as in the former dog, but was sensibly depressed. The vessels on its surface were reduced to mere hairs. The brain was remarkably pale, and the choroid plexus bloodless. No blood was found in any of the sinuses, except at the exit of the lateral ones. About a drachm of serum was found at the basis of the brain.

A third dog was trepanned. The dura mater was slit open, the carotids and jugulars were then wounded, and the animal suspended by the heels. Three hours after death, the lateral sinuses at the

basis of the skull contained a good deal of blood. There was a little also within the longitudinal sinus, and about a drachm and a half of blood was found effused between the dura mater and pia mater. The vessels on the surface of the brain were a little more distinct than in the other two dogs, but still very small and bloodless. The substance of the brain, the corpora striata, and choroid plexus, were all very pale. The cerebellum was more vascular and better coloured than the brain. There was a very little serum at the basis.

Comparing, then, these with the observations made on animals bled to death by simple hæmorrhage, it appears that, when the head is entire, the brain still contains a considerable quantity of blood,—when previously perforated, very little: the brain continues to fill the cranium in the one case, and subsides within it in the other.

The same causes which maintain the plenitude of the cranium, and oppose the depletion of the vessels of the brain, may be presumed to present also natural and constant obstacles to the repletion of those vessels; or, as from a consideration of the structure and situation of the brain, it does not appear very conceivable how any portion of its circulating fluid can be withdrawn from within the cranium, without its place being simultaneously occupied by some equivalent; so neither does it seem consistent with the notion of a constant plenitude, that any greater quantity of blood can be forced

within the vessels of the brain, without an equivalent compression or displacement.

There are occurrences and accidents in human life, and some diseases also incident to man, which bear on the question of repletion and congestion, with all the force of direct experiment; for, in these, all the conditions required by an experiment, instituted for the very purpose of ascertaining the possibility or impossibility of forcing more than the natural quantity of red blood into the vascular system of the brain, are present.

I. The first case of this description which offers itself to our consideration, is that of death from suspension, suffocation, or drowning. In all these modes of violent death, respiration is immediately and completely interrupted. The lungs and right side of the heart become congested, and a general obstacle is interposed to the return of the blood by the veins from every part of the body. In the case of suspension, besides the interruption of respiration, the carotid arteries supplying the greater part of the blood to the brain, and the jugular veins returning almost the whole of what is circulated within the head, are compressed by the cord; while the vertebral arteries remaining free from obstruction, are presumed to continue to transmit blood to the cerebrum, so long as the heart continues to act.

For some minutes, then, after the victim has been suspended, blood will probably continue to be

sent to the brain by the vertebral arteries, if not also, in some quantity, by the carotids, while its return from the head must be nearly or altogether intercepted by the compression of the veins, and the interruption of the respiration. Thus the conditions of the case are such as ought to produce fullness and turgidity of the vessels of the brain, if these be capable of such repletion in a healthy state of the viscus; for the vessels of the head, face, and neck, exterior to the cranium, are, from similar conditions, found in a highly gorged and congested state. It was for a long time accordingly believed by physicians, that death from strangulation is necessarily connected with cerebral congestion and apoplexy. The fact, however, is, that the appearances presented by the brains of those who have suffered by hanging or drowning, afford no countenance to this opinion.

Neither Valsalva, nor Morgagni (who discusses the question at some length), seem to have found any signs of plethora or congestion within the heads of the executed criminals, whose bodies they had opportunities of examining. In one dissection, for example, "*Cutis cranium tegens interiorem faciem sanguiferis turgebat vasculis. Cerebrum nihil, quantum judicare sensus poterant, ab naturali constitutione discrepebat;*" and so in other cases*.

De Haen, in whose time the question regarding the cause of death in the drowned and suffocated

* De Sedibus et Causis, epist. xix.

continued to be much agitated, furnishes us also with several interesting observations and experiments, which prove that neither suspension nor submersion kill by inducing an apoplectic or congested state of the brain. In the dissection of those who had perished in either way, he observed no such appearances. In one hung person, "Ventriculi cerebri superiores nonnihil lymphæ habuere, vix tertius, nihil quartus. Plexus choroidei naturales. Modicus admodum in sinibus lateralibus sanguis." And in another, "In hoc corpore notamus, in suspenso deesse apoplexiæ signa,—adesse peripneumoniæ." In a drowned boy, "Dura mater omnino naturalis; pia nonnihil rubicunda; ventriculi vacui omnes; plexus autem choroidei solito turgidiores. In sinibus lateralibus sanguis admodum paucus*." Again, in thirteen of the fifteen dogs which were hung or drowned for the purpose of ascertaining the morbid appearances, he could find no signs of apoplexy, neither fulness nor congestion, nor rupture of bloodvessels, within the head †.

The question was some years ago renewed in our own country, the subject having acquired a fresh interest from the discoveries which were making in the physiology of respiration, and from the institu-

* De Submersis, caput ii. Ratio Medendi, tom. viii. par. ii.

† De Resuscitanda Vitæ Suffocatorum, Suspensorum, &c. caput ii. Ratio Medendi, tom. ix.

tion every where of societies for the restoration of suspended animation.

Mr Kite and Mr Coleman were the most distinguished champions on either side of the question, the former defending the old doctrine, and the latter the new. Mr Kite accordingly affirms, that he and his friends generally observed in the brain of drowned animals a certain degree of fulness or distension of the veins *. Mr Coleman, on the other hand, asserts, as the result of numerous experiments, that the vessels of the head exhibit no appearance of distension in hung or drowned animals.

The trachea of a dog was laid bare, and secured by a ligature ; in less than four minutes he ceased to struggle. The veins of the head, Mr Coleman assures us, were less distended than natural. The two carotids of a dog were secured, and in half an hour afterwards he was hanged. On removing a large portion of the cranium, the vessels, says Mr Coleman, were much less distended than in ordinary death †.

On this subject I am indebted to the liberal courtesy of Dr Monro, to whom, as Professor of Anatomy in this University, the bodies of executed criminals are commonly sent for dissection, for some very interesting information, and for an opportunity of myself examining the brain of one who had been hung. “ I may mention a fact,” says the Professor

* Essays on Submersion.

† Coleman on Natural and Suspended Respiration.

in one of his communications which I omitted formerly, viz. “ that I examined the brain of a person who was hung, and found no internal congestion, but a great deal of blood accumulated in the vessels of the integuments.”

Shortly after this, I think on Friday, the 7th of December last, a female was hung at Montrose, and the body being forwarded to Dr Monro for dissection, he very obligingly favoured me with the following notes of the observations which he had made on her brain : “ The veins of the integuments of the head were much distended with blood. There was a slight effusion of a bloody water between the arachnoid coat and pia mater ; and, on removing the membranes, the brain was found to be rather of a paler colour than usual, and felt remarkably soft, so that it gave way at the corpus callosum, upon which some reddish coloured fluid was discharged from the lateral ventricles, but owing to the rupture I could not ascertain its quantity. The brain was much softer internally than externally, so that I could not demonstrate any of the deeper parts to my pupils,— a circumstance which never before occurred to me during the nineteen years I have been a professor. Since I wrote to you I have found a few observations I had made on the brain, and, amongst them, particular mention is made of the softness of the brains of criminals.”

On the 9th January last two pirates, Heaman and Gautier, were hung at Leith, and Dr

Monro very politely afforded me the opportunity of being present at the examination he was to make of the brain of one of them immediately after execution. The bodies, on arriving at the theatre in the College, were still warm, and their limbs flexible. Their countenances were livid, not much swollen, and no way distorted. Their mouths were shut, and their eyelids open. One eye of each subject was more reddened and suffused than the other. There was no frothy mucus about their mouths, nor did the rectum or bladder of either appear to have been voided during execution. I have been informed, indeed, that these men seemed to die speedily, and with little struggle or apparent suffering. There was no dislocation of the neck, no wound nor laceration of the integuments, though the mark of the rope was distinctly visible on the neck of each. I have remarked that one eye only of each subject was much reddened and suffused, and I observed also that the corresponding side of the face of each was evidently more livid than the other, and the truth of this observation was admitted by several of the gentlemen present, to whom I made the remark. The manner in which the instrument of death is adjusted affords, I think, a ready and natural explanation of the fact. As the noose of the cord is adjusted by the executioner on one side of the neck, it becomes, as it were, the point of suspension, so that, by the weight of the victim, it slips upwards from the neck on that side towards the mastoidal process behind the ear; and

there is, consequently, a space on this side corresponding to the rising of the noose, which is not embraced by the cord, and where the veins, returning the blood from the head, are subjected to little, if any, pressure. The mark of the rope, accordingly, did not form a circle round the whole neck, but was observed to rise obliquely upwards, behind the ear, on that side on which the eye was the least suffused, and the countenance the least livid.

On dividing the scalp the blood flowed freely, and in such quantity as to afford ample proof of the congestion of the vessels exterior to the cranium. The dura mater adhered very firmly to the bones, but exhibited no deviation from its usual appearance. All the sinuses contained blood, but in no extraordinary quantity. The larger vessels on the surface, and between the convolutions of the brain, were but moderately filled, and the pia mater was, upon the whole, paler, and less vascular, than we often find it in ordinary cases. About half an ounce of colourless fluid was found at the basis cranii, and there was some appearance of serosity between the membranes. The texture of the brain was rather soft, but the cineritious and medullary portions of its substance exhibited, as to colour and vascularity, nothing characteristic or remarkable. No sooner was the brain removed than the blood, yet warm, began to rise and flow profusely from the divided sinuses and vessels at the base of the skull. Rather more than a pound escaped in this way, and afterwards coagulated on the floor.

It is remarked by Morgagni, that the fluid state of the blood in the dead bodies of those who have suffered by suspension or strangulation, accounts for the little appearance of fulness of the vascular system within the head, although the integuments of the head and face are gorged with blood : For, on the removal of the cord, he observes, that the fluid blood will easily flow back from the brain and its sinuses, towards the heart, through uninterrupted vessels, so large and pervious as the internal jugulars are, while it cannot so easily find its way through the numerous ramifications of the smaller cutaneous veins*.

But if we consider this matter rightly, we shall, I think, be led to a very different conclusion. The

* Porro, idem sanguinis fluor, qui in iis erat quos, cum sani essent, violentia externa strangulavit, admirationem minuit quod in iisdem Valsalva cerebrum invenerit ab naturali statu nihil discrepans, aut crassioris meningis vasa nonnihil dumtaxat sanguine turgida, cum interea cutis cranium tegentis interiora vascula, et quæ oculis circumjecta sunt, aut per retiformem horum tunicam, aut per aurium tympanum feruntur, adeo turgent; ut aliæ harum partium inflammatae viderentur, nonnullæ, ut membrana tympani, et annexa ossicula, tinctæ etiam sanguine apparent. Soluta enim laqueo, amplissimisque viis internarum jugularium venarum redituro sanguini reclusis, multo maxima hujus, quippe fluidi, pars è cerebri sinibus, venisque majoribus in hos desinentibus, facile defluxit, cum is qui per anfractus, angustiasque magis dissitarum venularum minus expeditum haberet, in iis subsisteret, nonnullis earum exceptis, quas aut magis plenas, aut minus resistentes laqueus ante disruptisset, aut alia exterior violentia.—*Morgagni*, Epist. xviii. 11.

cord cannot be, and never is, removed till the subject is cut down and laid in the horizontal posture, when the blood can have no tendency to gravitate towards the heart. The occurrence, indeed, which took place after the removal of Gautier's brain proves the contrary,—that, in the horizontal posture, the blood, while fluid, must be rather gravitating upon the brain, and that the fluid congested in the right side of the heart, cava, and jugulars, is actually pressing upon that within the sinuses of the brain, for when the vessels were divided within the head, the blood flowed upwards into the skull.

I have long known, indeed, that, in consequence of this very circumstance, much more blood has seemed, in many cases, to have been contained within the head than actually existed within its vessels. Sometimes in opening the head, the sinuses are wounded by the saw, or torn in removing the upper portion of the skull from its strong adhesion to the dura mater, and then I have not unfrequently seen blood continue to escape in such quantity as the sinuses themselves were incapable of containing, and that, too, without the veins on the surface of the brain appearing to have been thereby emptied, so that I have never doubted that the greater part of this blood had pressed upwards from the jugulars and cava. When the brain is removed it is very usual for the blood to press upwards, and flow into the skull.

I have sometimes, however, called the attention of those assisting me in dissections to a very diffe-

rent state of the vessels within and without the head, —cases in which the jugulars and cava were empty, while the sinuses and veins within the head contained their usual quantity of blood. This state of the vessels was observed in the case of anæmia, given in the former part of this paper, and in the following case.

Mr L.'s child, a girl about two years of age, was, on the 12th November last, attacked with symptoms of acute bronchitis, a disease at that time very prevalent among young people. The case was from the beginning actively treated by bloodletting, blisters, and antimonials, and, in a few days, the dyspnoea, and more urgent symptoms, seemed considerably relieved; still the child did not convalesce, but continued hectic and feverish. Nothing farther remarkable occurred till the 2d December, when it was reported to me that the child for a day or two had at times experienced great difficulty in swallowing, and that now the dysphagia was complete. A careful examination of the external and internal fauces satisfied me that there was no inflammation or tumor. A blister was applied to the nape of the neck, and in a few hours from the time it began to act, the power of swallowing was recovered. On the 4th, however, the dysphagia returned, and was again relieved by blistering the external fauces. The relief, however, was of short duration. On the 6th the child could swallow nothing, and notwithstanding every remedy used, the power of deglutition could never be restored. She was thirsty and

anxious to swallow, but not a drop of any thing whatever passed downwards from this time till the 12th, when she sunk apparently from mere exhaustion. On dissection, the fauces, pharynx, and œsophagus were found in a perfectly natural state. The trachea and bronchiæ were loaded with purulent fluid, and there was adhesion of the left side of the lungs to the pleura. All the abdominal viscera were remarkably pale and bloodless. Very little blood was found in the heart. The sinus venosus and cava, and the carotids and jugulars of both sides, were perfectly empty. The sinuses of the dura mater were well filled, and the veins of the pia mater ramifying between the convolutions of the brain, were plethoric and congested. At the basis cranii, and in the vertebral theca, there was found rather more than an ounce of serous fluid, but none in the ventricles.

I have seen, also, in the animals which we bled to death, the vessels of the neck, till they entered the bony foramen of the cranium, empty, though the communicating sinuses within the skull were well filled with blood.

I consider these observations on the relative state of congestion of the veins, within and without the head, as good illustrations of the difficulty of repleting, or depleting, the vascular system of the brain; for, on the one hand, we find blood pressing upon the brain from the congested jugulars, cava, and right side of the heart, without finding any entrance into the head, till the sinuses are wounded,

and the brain removed; and, on the other, the vessels within the head are found replenished with blood, though their continuations without the head are empty.

II. Another condition, which has been presumed to have a tendency to produce fulness and congestion of the vessels of the brain, and consequently to act as an occasional or exciting cause of apoplexy, is stooping or other low positions of the head. I believe, however, that the influence of posture has, in this respect, been somewhat overrated. I think it quite certain, at least, that in a previously sound and healthy condition of the brain and its vessels, no change of posture can impel into, or confine more or less blood within those vessels than naturally belongs to them, though I am willing to allow that the general pressure of the circulating fluid may, in this way, be, under certain circumstances, increased or diminished, and the circulation through the head accelerated, retarded, or disturbed.

Healthy individuals may stand on their head, hang by their heels, or change the posture of their bodies in every possible way, as we observe in the gambols of school-boys, or the more curious feats of adult and professed tumblers, without sustaining the slightest injury or inconvenience. Many of the occupations and employments of industrious life are carried on in a continued stooping posture, as in the acts of weeding, reaping, gleaning, planting, digging, washing, and many such like. Miners, shoemakers

too, and other artizans, work the whole day in very constrained and stooping postures; and the sailor, in the act of furling and reefing, hangs over the yard-arm in such a way that his head is not unfrequently the lowest part of his body. In some instances of deformity, decrepitude, and disease, we occasionally observe individuals bent almost double, and compelled to move about with their head stooping almost to the ground. Yet in these, and many other such examples of constrained situation and stooping posture, whether from choice, necessity, or infirmity, the circulation within the head continues to go on freely, and these subjects have not, I apprehend, been observed to be more prone to congestive diseases of the brain, to palsy and apoplexy, than those whose more fortunate circumstances permit them "*erectos ad sidera tollere vultus.*"

The heart continues to pulsate for several minutes after every other sign of life has been destroyed, by an adequate dose of hydrocyanic acid, and the blood continues fluid for a still longer time. In order, therefore, to ascertain, as far as such an experiment can do, the total effect of the gravitation of the blood upon the vessels of the brain, I immediately, after administering a destructive dose of prussic acid to two dogs, suspended the one by the heels, and the other by the ears, and allowing them to remain thus suspended for eighteen hours, they were taken down for examination.

In the dog suspended by the ears, the muzzle, gums, tongue, and integuments of the head were

found pale and bloodless, and the jugulars empty. The dura mater had few conspicuous vessels; those of the pia mater were tolerably large and numerous, but not turgid; the brain itself was well coloured, seemingly with arterial blood, especially within the ventricles; the sinuses did not contain much blood; the serous effusion at the basis of the brain amounted to nearly a drachm. In the dog suspended by the heels, all the external parts of the head were much congested and highly coloured, and there was a small effusion of blood under the fascia of the temporal muscles; all the veins of the head, and the jugulars of the neck, were loaded with blood, even to turgescence. The dura mater exhibited no increase of vascularity. The veins of the pia mater were rather more filled, and the sinuses were decidedly more turgid than in the other dog, but there was no palpable quantity of serum in any part.

Thus, the effect of posture on the parts exterior to the skull is very great; in the one dog, the integuments were pale, and the vessels completely empty; in the other, they were filled and congested to the greatest possible degree. Within the head the contrast was but trifling. The sinuses beyond all doubt were loaded in the one case, and rather empty in the other; the difference of appearance in the other parts of the brain was but little striking.

III. Some diseases of the heart, and of its larger

vessels, constitute cases in which we might expect to find the brain more plethoric and congested than usual. In obstruction of the auriculo-ventricular valves, an obstacle exists to the free return of the venous blood from the head; and in muscular enlargement of the heart, not unfrequently complicated with contraction of the descending aorta, the impetus of the blood upon the brain is often powerfully increased. Sometimes, too, these conditions, either of which seem so well calculated to produce fulness and congestion of the vessels within the head, are found united in the same case, obstruction viz. to the return of venous, and increased impetus of arterial blood. Yet, I believe it will be found that, in a sound condition of the brain and its vessels, such diseases of the heart have little or no tendency to produce lethargy, palsy or apoplexy, nor by consequence plethora, congestion, or disordered circulation within the head, although the livid, bloated, and sometimes swollen countenance, and the turgid and throbbing neck, bear ample testimony to the existence of plethora, obstruction, and congestion, in the vessels exterior to the cranium. Of the several cases of enlargement, and of other structural diseases of the heart, which have come under my own observation, not one of the patients had lethargic or apoplectic symptoms. One only had a partial paralytic affection of the right arm.

During the spring 1814, Mr B. had been complaining a good deal, but without any peculiar or

definite symptoms. It had merely been remarked by his friends, that he was looking ill, and did not enjoy his usual health and spirits. He continued, however, to vacate his affairs during a time of great commercial embarrassment, without any particular inconvenience or inability. On the 1st March, he complained to me for the first time of an inconvenience he experienced in the act of writing, a necessity of writing more slowly than usual, and an inability of forming the letters with his accustomed accuracy. This disability was accompanied with headach and vertigo, and being considered by me as a paralytic affection, depending on increased pressure on the vascular system of the brain, he was bled on the 3d, 7th, and 12th March. His bowels were kept open, and an anti-phlogistic regimen enjoined, by which means these symptoms were relieved, but not removed. He continued, however, to go abroad, and do business as usual, so that after the 12th March I ceased to visit him at his house, and occasionally only used to meet him in the street.

On the 1st May I was again consulted, and informed that his nights were restless and sleepless,—that he complained of a sense of oppression at the breast, and of suffocation at the throat, whenever he laid himself down on bed, or assumed the horizontal and recumbent posture,—of palpitation, of headach, and vertigo,—of costiveness, and of discharge of blood by the anus,—of breathlessness on the slightest exertion, and of general prostration of

strength. These symptoms led me to examine very particularly the condition of the heart, and of the larger vessels of the thorax and neck. From the tumultuous throbbing over a great extent of the chest, the laboured action of the heart, and the pulsation of the aortic arch, both felt and seen immediately above the sternum, I entertained little doubt of the existence of aneurism of the aorta, and of enlargement of the heart. Yet I did not at this visit consider things so far advanced as immediately to endanger life. The action of the heart was, however, too powerful, and could not be controlled; the blood was projected with surprising force upon the aortic arch, the carotids, and the head; alarming hæmorrhagies took place both from the nostrils, and per anum; the horizontal position was insufferable, and several days and nights were passed without sleep in the chair. The stomach became affected and retained nothing,—violent sickness and bilious vomiting ensued,—he was restless, anxious, and uneasy, and on the 13th of the same month he died.

The heart was found enlarged to twice the usual size, not by simple dilatation, but by a real increase of muscular structure, as well as of capacity. The aorta, also, from its origin, through the whole extent of its arch, had nearly twice the ordinary capacity;—its coats were thickened,—the internal coat was inflamed and studded with several gritty tubercles or ossifications. All the valves were sound. There was an ounce of water in the peri-

cardium. The lungs and abdominal viscera were sound. The head was not opened.

Now, notwithstanding the slight paralytic affection of the right arm, and the headach and vertigo of which Mr B. complained, I consider this, upon the whole, as one of those cases where an apparent exception may be said rather to confirm than invalidate the rule; for powerful and awful as were the exertions of this heart, there was yet no stupor, no lethargy, no apoplexy, no congestion therefore, no rupture of vessels within the head, although such congestion and rupture happened in other parts of the system.

Mr G., with a numerous train of distressing symptoms, which too well marked the existence of enlargement of the heart, and of the violent propulsive energy of that viscus, had one only characteristic of any disturbance within the head. On looking upwards to the whitened ceiling of a room, he saw a darkened spectrum which vanished and reappeared with great regularity. It was soon discovered that the appearance of this umbra was synchronous with the systole of the heart, so that he used often, in my presence, to count his pulse with the utmost precision, by keeping his eye fixed on the ceiling, and numbering every appearance of the spectrum. But, independently of this curious symptom, every other function of the brain, during a protracted state of suffering, remained undisturbed till the last moment of his existence.

On dissection, the heart was found greatly en-

larged, but without any increased thickness of its parietes. The auricular valves on the left side were rigid and thickened.

Mr L.'s case was very similar in its progress to the preceding. I had no doubt of the nature of the disease from the moment he consulted me. The heart acted with amazing force; the pulse varied from a hundred to a hundred and twenty; the respiration was easily affected by the slightest exertion, and there was much of anxiety and restlessness. The more urgent symptoms were occasionally relieved and parried by bloodletting. After several months of suffering, his legs began to swell,—his breathing to be more and more difficult, and in one of those paroxysms of dyspnoea he died. But the functions of the brain remained unimpaired and unaffected during the whole of his illness.

The heart was much enlarged; the ascending aorta was rather larger than usual, but immediately below the origin of the left subclavian, there was a remarkable contraction to the extent of fully one-half of its diameter, below which the vessel again swelled out into a sort of aneurism by dilatation. In this case, then, with an enlarged heart pulsating with furious energy, and an aorta stricured just below the origin of those vessels through which the blood is directly impelled on the brain, we had yet no symptoms of congested or deranged circulation within the head.

A still more remarkable case of solid enlarge-

ment of the heart, with obstructed aorta, is recorded by Dr Graham, in the 5th volume of the Transactions of the London Medico-Chirurgical Society.

The walls of the left ventricle were about an inch in thickness. The aorta expanded unusually near its origin, so as to form a kind of pouch, but after giving off the branches to the head, and superior extremities, its diameter was preternaturally contracted. It was continued of this diminished size till after its union with the canalis arteriosus, where it was completely impervious. The arteria innominata, the left subclavian, the superior intercostals, and mammary arteries, were much enlarged. The throbbing of the carotids and subclavians was very remarkable; there was dyspnœa and palpitation of the heart; the pulse was at one report 100 and firm; at another it is described as full, strong and sharp; he had febrile attacks, pain, nausea and vomiting; but in the whole account of this interesting case, I do not find the slightest notice of any symptom marking disorder of the circulation within the head*.

Few physicians have enjoyed more extensive opportunities of observing the effects of structural diseases of the heart than Corvisart, and yet with a strong prejudice in favour of the supposed connection between these diseases and apoplexy, he frank-

* Transactions of the Medico-Chirurgical Society of London, vol. v.

ly avows that his practice does not furnish him with a single fact of this kind, which he adds is a little extraordinary, considering the numerous cases of this disease which have fallen under his observation*.

The proper inference, I think, is, that such structural diseases of the heart, however much they may seem calculated to force blood upon the brain, or to impede its return by the veins, have yet little or no effect on the circulation within the head; or, that whatever tendency such diseases of the heart and larger vessels may have to produce plethora, congestion, or deranged circulation within the head, that tendency is opposed and counteracted by the physical situation of the brain, and the peculiar confinement of its vascular system.

It would be still more extraordinary, however, if coexistent diseases of the brain and of the heart were not occasionally met with.

The texture of some part of the brain may be softened or otherwise diseased, tumors or changes of structure may be formed or advancing to maturity within the head, or the arteries of the brain may be themselves in a morbid state, dilated, atheromatous, ossified, or aneurismal. In all or any of these cases, the coexistence of structural diseases of the heart, and larger vessels, may materially influence the character, severity, and progress of the cerebral disease. Thus may a subject with struc-

* *Maladies de Cœur, par Corvisart.*

tural disease of the heart, have symptoms also of a morbid condition of the brain ; or, be simultaneously affected with headach, vertigo, amaurosis, paralysis, or coma, or die suddenly from apoplexy ; and the sooner, perhaps, that a diseased heart was propelling the blood with increased energy upon, or retarding its return from the brain. In fact, if we attend to those cases where cerebral symptoms have coexisted with those of diseased heart, we shall often, perhaps always, find that there was an independent disease of the brain itself, quite adequate to the production of all the symptoms referable to that organ, though no disease whatever had existed in the heart or larger vessels.

For example, a mantua-maker, twenty-four years of age, who laboured under symptoms of active aneurism of the heart, had also complete paralysis of the left side. The heart on dissection was found to occupy “ the greater part of the chest, and had “ acquired,” says Corvisart, “ an extraordinary size, “ considering the small stature of the subject. The “ cavity of the left ventricle had acquired a very con- “ siderable size, and its parietes were much thicker “ than natural. The aortic opening and sigmoid “ valves were free and natural, but the mitral valves “ were tuberculated*.”

Now, had the chest alone been opened in this case, it might have been produced as an example of paralysis, arising from the increased propulsive

* Corvisart.

energy of this enlarged and obstructed heart, forcing into or confining too much blood within the vessels of the brain. But on opening the head, the substance of the right hemisphere of the brain was found in a state of manifest decomposition, of a grey colour, and of the consistence of thick paste.

Malpighi's case, too, which Corvisart cites as an example of connexion between apoplexy and diseases of the heart and large vessels, is still, in my apprehension, one rather of coexistence than of causal connexion. This eminent person was afflicted with gout and stone, was subject to palpitations of the heart, and died of a second stroke of apoplexy. The heart was found to be thickened and enlarged, and the right ventricle of the brain is said to have contained two pounds of blood. But, then, all the cerebral vessels were varicose and diseased, one of the most common perhaps of all the causes of sanguineous apoplexy with rupture of vessels and effusion of blood*.

I had lately an opportunity, along with more than one member of this Society, of witnessing the dissection of the body of a man who had died rather suddenly in one of our public institutions. This man, thirty-two years of age, was admitted on the 9th of January last, for the treatment of amaurosis. He complained besides of pain of head, particularly over the right eyebrow. The right eye had become suddenly affected about five months previous-

* Vide Baglivi, Morgagni, and Corvisart.

ly, and shortly after the left one. He had been subject to headach for six years, though in other respects his general health appeared good. On the seventh day after admission, he complained of great pain over the right eye, had dyspnœa, cough and vomiting, frequent pulse, and thirst. On the ninth, without any alleviation of the previous symptoms, he had great tendency to sleep; coma supervened with laborious respiration, his countenance became pale and ghastly, and at one o'clock next day he died.

“ Upon examining the brain, the veins upon the
 “ surface were not much distended with blood, nor
 “ were the smaller arteries very conspicuous. There
 “ was a slight effusion of serum under the arachnoid
 “ coat. The brain throughout felt particularly firm,
 “ but, when cut into, did not exhibit any marks of
 “ great vascularity; and there was no fluid in the
 “ ventricles. Upon examining the basis of the brain,
 “ there was no effusion as on the surface, but there
 “ was a marked change in the arteries. The carotids,
 “ the vertebrales, basilar, and those vessels forming the
 “ circle of Willis, were much thickened in their coats,
 “ and felt extremely tough; and the branches sup-
 “ plying the brain, particularly the anterior cerebri
 “ of the left side, were studded with various spots of
 “ ossification, which, however, did not render them
 “ brittle. The carotids, where they were in contact
 “ with the optic nerves, were much thickened in their
 “ coats, and the whole of the arteries felt so tough that
 “ they could easily be followed out. The optic nerves
 “ were also very firm. The cavity of the thorax was

“ quite healthy, excepting the heart, which was much enlarged; when cut into, the ventricles, particularly the left, were found much thickened. There was a large polypus of a yellow colour distending the right auricle, and passing for some way into both cavæ; it descended for some way into the ventricle, and completely obstructed the passage. All the valves of the heart were healthy*.”

I have produced this case as a very interesting example of the coexistence of structural disease of the heart and brain, and of their mutual independence. The power of the systemic heart was greatly increased, and the pulmonary was much obstructed. It was just such a heart as seems calculated at once to force blood upon the vessels of the brain, and to retard its return by the veins, and so to produce plethora, congestion, or rupture of those vessels. The cerebral arteries were themselves diseased, enlarged somewhat, changed in structure, and here and there studded with atheromatous or ossified spots;—they were, in short, in a state of predisposition to congestion and rupture; and I do not, I think, hazard much when I take it upon me to say, that this man was thereby predisposed to apoplexy, and that, if his heart had been perfectly sound,—had he laboured under no other disease or predisposition than what was found to exist in the arteries of the brain,—he might indeed have lived longer, but would sooner or later have become paralytic or apoplectic. The predisposition, however,

* Extract from the Public Records of the Charity.

was not as yet sufficiently far advanced; and thus even so powerful an exciting cause as an enlarged and obstructed heart, was unable to produce congestion or rupture of diseased arteries,—and if not of vessels in a well known state of predisposition, how little reason does there remain for believing, that structural diseases of the heart and larger bloodvessels have any great efficiency in the production of plethora or rupture within the head, in a healthy state of the vascular system of the brain?

IV. Ligatures and tumors compressing the vessels of the neck, so as to impede or retard the free return of blood from the head,—the pressure of thoracic and abdominal enlargements and tumors on the aorta or cava, or other impediments to the free passage of the blood to or from the heart, constitute another class of cases, which have commonly been considered as having a natural tendency to force more than the usual quantity of blood upon the brain, and which have accordingly been very generally regarded as efficient occasional causes of apoplexy. I think, however, it will not be difficult to shew, that even these have little influence upon the circulation within the head, in a sound and natural condition of the brain and its vessels.

Mr Abernethy tied the carotid of a man who had been gored in the neck by a cow. The patient soon after became delirious, convulsed in the left side, paralytic in the right, and died thirty hours after the ligature of the artery. Appearances of

inflammation and effusion of blood were found on the surface of the brain, a gelatinous deposition beneath the arachnoid membrane, and watery effusion within the ventricles. Upon reflection, Mr Abernethy observes, " I can form no other opinion of the case than that which first struck me, which is, that though stopping the supply of blood to the brain did not for several hours produce any apparent derangement in the functions of that organ, yet such a state was gradually occasioned by it, and which was attended, like the effects of concussion of the brain, with inflammation." And he adds, " that an effusion of blood in the left hemisphere of the brain would affect the opposite side of the body in the same manner that cutting off the supply of blood to the left side appears in this instance to have done*."

At a time when we had but little, if any experience of the effect produced on the circulation within the head, by the ligature of one of the principal vessels supplying the brain with blood, Mr Abernethy's reflections were quite natural, as the event of this unfortunate case was in perfect accordance with, what I may be pardoned for calling, a pathological prejudice of our schools; so that, if this had remained a solitary experiment, it might now have stood in our way as a good illustration of the common doctrine.

* Surgical Observations, by John Abernethy, F. R. S. London 1804.

The carotid, however, has been since so frequently tied, and with such unvaried success, as to convince us that the obstruction of this vessel has no tendency whatever to produce derangement of the circulation within the head, or of the functions of the brain, insomuch that, in cases of aneurism, the ligature of the common carotid has now become an established and fearless operation of surgery. So little, indeed, is this operation, in so far as its influence on the functions of the brain is concerned, now dreaded, that surgeons have even ventured to tie the common carotid, with the intention, and with the effect too of interrupting or weakening vascular action and turgescence of parts exterior to the cranium, without, however, the fear of deranging, and without actually having deranged, in the slightest degree, the circulation within the head, as in those cases of aneurism by anastomosis in the orbit, which have been cured by tying the common trunk of the carotid by Mr Travers and by Mr Dalrymple*.

There is probably no known case in which the circulation through both carotids has been interrupted in man; but in the lower animals, whose brains are supplied with blood by arteries similar in their origin and distribution to our own, both carotids have been tied with perfect impunity. The ancients indeed believed, that the compression of

* Medico-Chirurgical Transactions, vols. ii. and vi.

those vessels was followed by stupor and lethargy*. But we have a series of experiments on the ligature of the carotids, from Galen down to Valsalva, and to the present day, which prove, contrary to this prejudice, that the ligature of both arteries produces no disturbance whatever in the functions of the brain †. The animals on which I have repeated this experiment, though kept alive for several days afterwards, appeared to suffer no inconvenience whatever.

Almost the whole of the blood circulated through the brain, is returned to the heart by the internal jugulars, and yet the obstruction or ligature of one of these veins at least, does not appear to be productive of any derangement of the circulation within the head,—of none at least capable of disturbing the functions of the brain.

Mr Simmons, in extirpating a tumor from the neck, divided and tied the internal jugular vein. The patient recovered; and it is especially remarked, that no morbid affection of the head was the consequence of this operation ‡.

A similar case is related in the 5th volume of the Edinburgh Medical Essays. After laying the

* Carotides (vel arteriæ somniferæ) a ΚΑΡΟΣ, *sopor*.

† Non parvi momenti est pro Galeno, de tribus canibus, in quibus Valsalva ejus iteravit experimentum, ne unum quidem fuisse qui aut sopore, aut obmutescencia corripereetur.—*Morgagni*, Epist. 19-29.

‡ Medical Facts and Observations, vol. viii.

vein bare a considerable way, Dr Simson observes, " I found it confounded at the lower part with the substance of the tumor ; and therefore, putting a ligature round the vein, I tied it, and then cut away the remaining part of the tumor below." The cerebral functions appear to have suffered no disturbance from the ligature of the vein*.

Mr Lardner, after describing a case in which he found the internal jugular obliterated by a tumor in the neck of a woman, remarks, as one of the interesting circumstances of the case, the very slight disturbance of the functions of the brain, notwithstanding so great a derangement of its circulating system had taken place †.

Another case, very like to this, occurred in the practice of Mr Young. " A sailor, about fifty years of age, had an ulcer in the fauces, which communicated with a chain of tumors surrounding the larynx and pharynx, and affording great impediments to respiration and deglutition. The tumors increased during several months, when the patient died, worn out by the irritation and pain which they excited. When dissected, these tumors were found to consist of a soft medullary matter, contained in a cellular structure. One of the tumors projected into the fauces, and had excited ulceration, which extended to the epiglottis. The carotid artery and the external jugular

* Edinburgh Medical Essays, vol. v.

† Edinburgh Medical and Surgical Journal, vol. vii.

“ vein were enveloped in these morbid growths.
 “ The cavity of the artery was of its natural size,
 “ and its coats were healthy. The left internal ju-
 “ gular vein, for the extent of two inches, where it
 “ passed through the tumors, was completely obli-
 “ terated*.”

We had lately a patient in the Leith Dispensary, a man of the name of Veitch, who died suffocated by the pressure of a large medullary sarcoma, which occupied the whole of the neck, extending from ear to ear, and from the chin to the sternum. Deglutition was impeded, respiration difficult, and the countenance swollen and livid. On dissection, all the vessels of the neck were found involved in this large tumor, whose weight may be fairly estimated at somewhat more than two pounds; and yet, as I am informed by Dr Macaulay, who had the charge of him during the last days of his existence, no symptoms occurred indicative of disturbance of the circulation within the head.

It was long believed, on the authority of Aristotle, that the ligature or compression of both internal jugulars was productive of stupor and insensibility. The experiment, however, repeated by Galen, and since by others, has not been followed by any such remarkable result. There are contradictions, it is true, in the observations of different experimenters; but the general conclusion seems to

* Hodgson's Treatise on the Diseases of the Arteries and Veins.

be, that the ligature of the jugular veins of the lower animals is not necessarily followed by any disturbance of the functions of the brain. Morgagni, however, has, by a critical examination of those experiments, rendered it doubtful what were the veins actually secured in most of them, whether external or internal. He remarks, that the experimenters have not generally been sufficiently explicit in their accounts,—that they have sometimes omitted to name the animals operated on, or to tell in what part of the neck the veins had been tied in the dog, when that animal is distinctly mentioned,—that few had made the necessary examination after putting the animals to death, in order to ascertain whether or not the vessels had been properly tied and had continued obstructed, or had made themselves acquainted with the peculiar distribution and communications of those vessels*.

* “ Sed neque dixit, quo in genere animalium, nec qua in
 “ colli sede, venas constrinxerit. Quorum utrumque eos cogi-
 “ tasse, æquum fuerat, qui ejus vellent experimentum in du-
 “ bium vocare. Nam quod ad primum attinet, recentiores
 “ hæc fere solent in canibus, quos ille vel mortuos quam raro
 “ dissecuerit, neminem fugere potest in ejus lectione versa-
 “ tum : quibus autem vivis animalibus ad experimenta utere-
 “ tur, quod ad nervos quidem attinet, scimus ; quod vero ad
 “ sanguifera vasa, si rectè memini, nescimus : et tamen aliam
 “ in aliis animalium generibus esse posse vasorum dispositio-
 “ nem, aut communicationem, quis neget ? quando haud raro
 “ in eodem genere, imo vel in uno eodemque animali, si quæ
 “ sunt in dextro, et sinistro latere inter se comparemus, varias
 “ illas esse, deprehendimus. Quamobrem et illum alterum

These objections seemed to Morgagni to be less applicable to the experiments of Lamure and Desnoves, than to those of others. Lamure tied the jugulars of a dog, as the experiment is described, immediately below the bifurcation, without effect; but when he tied the same veins lower down the neck of another, the animal was affected with profound stupor. Desnoves, by his account, tied both the external and internal jugulars in two dogs, and the animals are said only to have become heavy and sad*. Morgagni, therefore, concludes, that Galen might have really tied the internal jugulars without any remarkable occurrence in the subject of experiment, seeing that Desnoves had secured

“spectare decet, id est qua in colli sede ligatæ fuerint venæ
 “jugulares. Nam inter altiorem, et inferiorem sedem, sive
 “ob eam quæ modo indicata est, sive ob constantem causam
 “vel in canibus discrimen esse, conjicias licet ex Cl. Lamurii
 “experimentis. Hic enim cum aliud inquirens, multorum vi-
 “ventium canum jugulares internas venas spectaret, hasque
 “ad breve temporis spatium in duobus obligandas curasset;
 “in primo quidem postquam vinculum injectum fuerat infra
 “earum bifurcationes, soporem adnotavit nullum; in altero
 “autem cum injectum esset, quo ad fieri potuit, proprius tho-
 “racem, canis, inquit, incidit in profundum soporem.”

* “Et sane utrasque olim videtur intellexisse Novesius qui
 “externis simul internisque vincula injecit. Quod cum in uno,
 “itemque in altero fecisse cane, animadvertit quidem (id quod
 “apud Loverum non invenio) signa capitis facti ponderosio-
 “res, et lacrymas aliquot; sed canibus aliquo post tempore
 “mortuis, nihil quidquam seri extra aut intra cranium effusi
 “deprehendit.”—*Morgagni*, Lib. ii. Epist. 19. § 32.

both the external and the internal veins, without any greater disturbances having followed *. There is still something imperfect and unsatisfactory in the account of these experiments; and I have reason to think, that even those of Lamure and Desnoves are open to the doubts which Morgagni has cast on the experiments of their predecessors. In fact, the dog, the common subject of all those experiments, has, in reference to the anatomy of man, no internal jugular.

The common jugular, as I shall call it, is a very large vein situated superficially immediately under the skin of the neck of the dog, which, in its division and distribution, may be very aptly compared to the common carotid, for, like it, the common jugular ascends obliquely from the chest, giving off no remarkable branch but one, the transverse cervical, which supplies the parts about the shoulder, till it reaches a little higher than the upper third of the neck, where it bifurcates at a very acute angle into two principal and equal sized branches, the most external and continuous of which ascends to the head, gives some veins to the occiput, and then, a little before the meatus auditorius externus, it turns under the coronoid process of the jaw-bone,

* "Utcunque id est; certe Novesii observationes ostendunt, potuisse Galenum læsionem adnotatu dignam nullam videre paulo postquam internas adstrinxisset jugulares venas, quando internis simul, externisque constrictis, non plura Novesius animadvertit."—*Morgagni*, Lib. ii. Epist. 19.

gives off numerous branches to the neighbouring parts, and enters the cranium a small vein, to receive the blood from the sinuses of the brain; so that this small branch which perforates the cranium, is the only true internal jugular. The other great bifurcating branch of the common jugular, runs upwards and forwards to the face and throat,—soon divides into two veins of nearly equal size, the one proceeding to the larynx and adjacent parts, while the other, running upwards over the angle of the lower jaw, gives branches to the head and face,—passes under the zygoma to the orbit, and is now the ophthalmic vein, which receives a large portion of the blood of the sinuses of the brain. The branch which I have described passing to the larynx and adjacent parts of the throat, gives off a very slender vein which becomes recurrent, plunges deep into the neck, and running down nearly in contact with, and parallel to the carotid, and between it and the trachea, communicates with the subclavian vein; so that, when I first observed this recurrent branch, slender as it is, I concluded it to be the internal jugular. It is, however, no other than a very small reflected branch from the laryngeal vein.

The veins which have generally been tied in the dog, can, I think, have been no others than the common jugulars; and when these are secured, it is evident that all the blood returned from the brain by the internal branches must be intercepted, were it not for the small recurrent branch, which

preserves a communication between the laryngeal vein and the subclavian, and by which some portion of blood will still be conducted from the head to the heart.

If, in any of those experiments, one only of the great bifurcating branches (mistaken for the internal jugulars) had been tied, blood would still be transmitted from the brain by the other,—by the ophthalmic vein, if the internal,—and by the internal jugular branch, if the facial or external branch had alone been tied.

I have myself tied the common jugulars in dogs, but they suffered not the slightest inconvenience. They never refused their food, and seemed as lively and active as they had ever before been. One dog, on the third day after the experiment, contrived to rid himself of the rope with which he was secured, made his escape, and I am informed, is still living and well.

It is by no means clear what were the veins secured by Desnoves, as internal and external jugulars. If he tied the two great bifurcating branches, he performed a less satisfactory experiment than if he had tied the common jugulars; but if, mistaking the small recurrent veins for the internal jugulars, he tied these and the common trunks, then he must have intercepted all the blood which can directly be returned from the head by the jugular system of vessels. It seemed to me, therefore, desirable, that the result of such an experiment should be fairly ascertained. The common jugulars, accordingly, and

the recurrent veins, were all carefully secured by ligature as low in the neck as they could well be reached. The dog at first seemed to suffer no inconvenience. The two following days, however, he kept himself in the recumbent or crouching posture, was dull, but not stupid, paralytic, or lethargic; took his food regularly, and seemed pleased when caressed. On the fourth day, he regained his spirits, and continued brisk, lively, and so perfectly recovered, that he gnawed asunder his rope, and nearly made his escape. On the seventh day, being to all appearance in perfect health and strength, he was killed in one minute by a dose of prussic acid. Next morning we examined the head and neck. All the veins were found to have been accurately tied, and to have continued perfectly obstructed by the ligature. The vessels of the pia mater and brain were moderately filled, and the sinuses were distended with blood. There was no serous effusion, and the brain had a healthy and natural appearance. The repetition of this experiment was attended with no difference of result worthy of notice. We may rest satisfied, therefore, that the obstruction of the whole jugular system of veins in the dog has no tendency to disturb much the circulation, or to congest the vascular system of the brain. The truth is, that although the direct return of the blood by these veins be very completely intercepted, it may yet find a sufficiently free, though more circuitous passage to the heart, not only by the vertebral sinuses, which appear to me very large

in the dog, and which communicate freely with the sinuses of the brain, but also by forcing those anastomoses, which exist between the transverse cervical veins at the lower part of the neck and shoulders, and the branches of the external and internal bifurcations of the jugulars, which descend from the integuments of the head, and from the upper and back part of the neck. And that those anastomoses are very free, is, I think, demonstrated by the observation, that the ligature of the common jugulars did not occasion congestion even of the integuments of the head and other parts above the ligature.

Not only have the carotid arteries and the jugular veins of dogs been secured and obstructed in separate experiments, without stupor and insensibility having been induced, as the ancients had supposed; but both carotids and both jugulars have been tied up in the same animal, without having occasioned the slightest disturbance of the circulation within the head, of which we have an example in the following experiment by the Baron Swieten:

“ In cane, cui ante octiduum abscideram nervos re-
 “ currentes, ligavi utramque carotidem, nec potui
 “ observare illum aliquid mali inde pati: inveni
 “ enim hoc animal post alios octo dies elapsos vege-
 “ tum et elacre; ligavi tunc venas jugulares sine
 “ ullo observabili malo. Post quatuor dies inveni
 “ canem sanum omnino. Examinans tunc ligatu-
 “ ras carotidibus injectas inveni illas firmissime hæ-
 “ rere, et thrombum valde densum et compactum

“ hærere inter ligaturam et cor. Aperto cranio in
 “ cerebro nihil mutatum apparebat, imo cerebri vo-
 “ lumen potius auctum quam minutum appare-
 “ bat*.”

As the common jugulars were, I presume, the only veins tied in this experiment, and as the arteries and veins were obstructed at successive periods of eight days, it seemed necessary to have it repeated. The common jugulars, therefore, were tied at the lower part of the neck ; and immediately after the recurrent veins and carotid arteries were secured by ligature, from which the nerves were carefully excluded. For two days after this operation, the dog was dull and somewhat heavy, but afterwards recovered his spirits and activity. He was kept alive till the seventh day, when he was killed by the prussic acid. On dissection, the integuments of the head, and the contents of the cranium, seemed in a perfectly healthy and natural state ; the veins of the pia mater were moderately distended, and the sinuses at the basis were well filled ; there was no effusion. The veins and arteries which had been tied continued obstructed.

I know of no example in which both internal jugulars have been obliterated or obstructed in man ; but there is a case related by Dr William Hunter, the consequence of which to the circulation within the head, must have been equivalent to the obstruction of both these veins. The case was one

* Commentaria in Aphorismos Boerhaavii, tom. i. 173.

of aneurism of the aorta, in which the vena cava superior, and the common trunk of the left subclavian and jugular vein, were so much compressed by the aneurismal tumor, as hardly to have any thing left of their natural capacity and appearance. The account of the appearances observed in the dissection of this case, is preceded by a very full history of the symptoms and sufferings of the unfortunate individual; but amongst these I do not find one of functional derangement of the brain*.

As to tumors and enlargements within the abdominal cavity interrupting or rendering difficult the passage of the blood through the aorta or cava,—the effects of these appear also more than doubtful when we know, that the channels of these large vessels have been entirely intercepted in cases where no symptom of disturbed circulation within the head had been observed.

Of the obliteration of the aorta within the thorax, I have already produced Dr Graham's case as an example; another instance of the same kind occurred to M. Paris of Paris; and a third is referred to by Sir Astley Cooper,—in none of which was plethora or congestion of the brain indicated by the symptoms.

In dogs, Sir Astley Cooper tied the abdominal aorta; and, without any dread of thereby forcing too much blood within the vessels of the brain, he afterwards, in a desperate case of aneurism, ventured

* Medical Observations and Inquiries, vol. i. p. 323.

to secure by ligature the same vessel within the abdomen of a man who survived the operation forty hours. The day after the operation, the patient complained of pain all over his body, more particularly in the head; and in the same report, it is observed, that the carotids beat with considerable force, but no symptoms of congested brain seem to have followed*.

The descending cava has frequently been found obstructed, and even altogether obliterated, within the cavity of the abdomen, by the pressure of tumors and other causes, of which we have examples recorded by Dr Baillie, Mr Wilson, Mr Cline, Mr Hodgson †, and others; but I do not find that any apoplectic disease has been remarked as a consequence of such obstruction. And yet, in the case of obstructed cava by Mr Wilson, the venous system of the brain must have been exposed to more than usual hazard of congestion; for, amongst other anastomosing channels through which the blood was forced to seek its course to the heart, were the veins coming from the sinuses of the dura mater in the theca vertebralis and the sinuses themselves, which, together with the veins entering them, it is observed by Mr Wilson, were much enlarged; and the communications

* Surgical Essays by A. Cooper and B. Travers, Esq. London, 1818.

† Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. i. and iii.; and Hodgson's Diseases of Arteries and Veins.

between them and the sacral and lumbar veins were, he assures us, rendered very apparent by the blood contained in them.

I have thus passed in rapid review the most important of those circumstances, which, from the earliest era of medicine, have been presumed to have a powerful and undoubted tendency to force blood into, or to confine it within, the vessels of the brain, and so to produce a dangerous morbid congestion of that viscus,—circumstances which accordingly have very generally been enumerated by systematic physicians as the principal exciting causes of comatose diseases; and though I am aware of many objections,—though I know but too well the unlucky *pour* and *contre* which embarrass us in almost every subject of medical inquiry, I think a case has been fairly made out, proving that the agency of such causes has been greatly overrated;—that nature has guarded, with peculiar care, the brain and its vessels against such accidents from repletion and depletion, as they must otherwise have been constantly exposed to;—and that while the structure of this organ remains *healthy* and *unchanged*, and *its vessels sound*, those causes are little capable of occasioning plethora, congestion, effusions, or comatose diseases.

The real causes of apoplexy are changes which take place in the brain itself,—disorganisations and structural alterations of its own texture, and of its vessels, and membranes. There are other points, however, connected with the pathology of the brain, and

with the causes of the comata which still remain to be scrutinized, and especially the effects of those agents which have a direct and immediate influence on the cerebral functions, such as alcohol, the narcotic poisons, and cold; but the consideration of these is necessarily deferred to some future occasion.