On

The Connection between

Apoplexy

Disease of the Heart

Before proceeding to trace the connection between Apoplexy and disease of the Heart, I consider it necessary to make a few preliminary observations on the cerebral circulation, as very many of the statements I may hereafter make in this paper will depend on the views held in regard to this subject; and it is with no small difficulty that we enter on its consideration, since from the very nature of the investigations which have been made, doubt must for ever remain as to their correctness. The two views which are now entertained deserve our attention, and first of all I shall allude to that held by Monroe, Secundus, Kellie, Abercrombie.
They conceived the cranium to be a complete sphere of bone, which is exactly filled by its contents. The brain is closely shut out from atmospheric pressure, and from all influence from without, except what must be communicated through the medium of the bloodvessels which enter it. In an organ like this, it is highly probable, that no great increase in the quantity of blood within its vessels can take place, without something giving way to make room for it; its cavity, being already completely filled by its contents, and likewise that no diminutions can occur without the entrance of something to supply the place which had become vacant. Its contents too, are incomprehensible, at least from any pressure which can be exerted on them by the force of the heart's action.

In regard to the amount of pressure which may be exerted on
The brain by the heart's action, Dr. John Reid says, that though fluids are not absolutely incompressible yet it requires the weight of one atmosphere or 15 lbs on the square inch, to produce a diminution equal to one 22,000th part of the whole. Now this is so exceedingly small a change upon a mass equal in bulk to the brain, as not to be appreciable by our senses; and as we are not reasoning as mathematicians or natural philosophers upon 22,000th parts, but as physiologists and pathologists upon sensible quantities, we may fairly proceed upon the supposition, that the action of the heart can produce no change upon the quantity of fluid within the cranium; for the heart in its most violent contractions cannot exert a pressure equal to one atmosphere, or in other words, produce a diminution equal to one 22,000th part. Under ordinary circumstances the pressure upon the
inner substance of the blood vessels may be between three pounds, and four pounds on the square inch; and this may perhaps be increased to ten pounds or twelve pounds, during a very violent exertion. The inference to be drawn from these few observations is, that no material alteration can take place in the quantity of fluids within the cranium, but, that it must at all times in ordinary circumstances remain the same or nearly so.

Should these statements be correct it will be seen, how any cause tending to quicken or retard the general circulation would cause a rearrangement in the balance of blood within the cranium. Should there for example be increased activity of the circulation, the quantity of arterial blood sent to the head will be greater than usual, the arteries will consequently contain more than their proper amount
of blood, and as we have already shown that owing to its structure the quantity within the cranium must at all times be the same or nearly so, a corresponding diminution of the venous blood will take place. On the other hand, should there occur anything to retard the return of the venous blood from the head, a direct impediment will be afforded to the entrance of the usual amount of arterial blood, so that it will be present in smaller amount while the quantity of venous blood will be increased in proportion. The probable effects of these arrangements we will speak of, when we come afterwards to trace the connection between the plethora and distase of the heart.

We come now to consider the other view in regard to the cerebral circulation, which has been adopted by Dr. Burrows and others. He holds that this anatomical structure of the human cranium
does not justify the opinion, that it is a complete sphere but, that it is like other parts of the body subject to atmospheric pressure and capable of undergoing great, and material alterations in the amount of blood within its walls. The following quotation will show at once the views entertained by him on the subject. "The numerous fissures and foramina," he says, "for the transmission of vessels and nerves through the bones of the cranium appear to me to do away with the idea of the cranium being a perfect sphere like a glass globe to which it has been compared by some writers. If these were not always an equilibrium of pressure on the parts within and without the cranium, very serious consequences would arise at the various foramina of the skull. And then the contents of the cranium removed from the influence of atmospheric pressure? I think..."
not from other considerations. Atmospheric pressure is undoubtedly exerted on the blood in the vessels entering the cranium. This blood, by a well ascertained law in hydrostatics, must be transmitted in all directions through the fluid blood and hence to the blood and other contents within the cranium and in the natural state of the parts. The brain is defended from atmospheric pressure should we not expect to find the functions of that organ disturbed in some way when part of the walls of that sphere is wanting? But in children with open fontanelles and in adults who have lost part of the bones of the cranium we observe a peculiar disturbance of the functions of the brain from this gap in the walls of this imaginary sphere. But lastly, the effects of gravitation on the fluid contents of the cranium, and the effects of this cupping glass.
which will often draw blood from the vessels of the dura mater, causing eechymosis. There seems to us that the cranium is not a perfect sphere in the sense in which it has been supposed. Starting as these arguments at first sight appear, on closer examination, they will be many be considered inconclusive, as Dr. John Reid has I think very well shown in a recent review of Burrows's work. The whole subject, however, is one on which much remains to be investigated, and its nature is such that I am afraid it must ever remain involved in obscurity.

Having made those few remarks on the circulation within the cranium, I proceed to consider the connection between apoplexy and disease of the heart.

There are scarcely two subjects in medicine, which have occupied the attention of medical men more, than the two diseases I have just
yet strong to say it is only of comparatively late date that they first discovered a connection between them. Many eminent authors on Apoplexy have given minute and correct accounts of the morbid appearances seen in the brain but the examination of other organs, particularly the heart, seems entirely to have been overlooked by them. Isolated cases no doubt occur in which disease of the heart was discovered on dissection after death from apoplexy but such were looked upon as mere coincidences. The first author who has the merit of having carefully investigated the subject, was Portal. Struck with his observations other medical both in France and this country were led to pay particular attention to the facts stated by him, and nearly all of them came to the conclusion that not only did a connection exist but so intimate was it, that a large majority of those dying
from Apoplexy were found affected with diseased heart. So clear does this appear to the minds of many, that Hope and others look upon it as one of the best established facts in modern Pathology. Richerand, Bertin, Bonilland, and other accurate observers, who have enjoyed ample opportunities of investigating the subject, looked upon diseased heart as the cause and apoplexy as the effect, and stated as the result of their experience, that there were more deaths from apoplexy occurring in connection with diseased heart than even from the languishing constitution itself. Notwithstanding this we find St. Hilier and others stating that disease of the heart has little or no tendency to produce apoplexy. There seems however to be no doubt in the minds of most men that such a connection does occur, and should such still exist a careful examination of the cases mentioned
by Andral, Hope, Clandeminy Guillemain, Barrows, &c. will think bring conviction to the minds of even the most bigoted.

Let us now trace the manner in which apoplexy may depend on disease of the heart and first of all I would remark that all diseases of the heart which tend to propel a greater quantity of blood to the brain or which retard its return from that organ may probably be instrumental in causing apoplexy. Pure hypertrophy necessarily involves increased activity and energy of the circulation, the blood must consequently be driven with greater force into the delicate vessels at the base of the brain and be at a greater pressure on the inner surface of those vessels must take place which pressure must act on the surface of the brain. The increased force of the circulation may as Taulb
formerly stated cause a disturbance of the relative proportion of the venous and arterial blood. Either of both of these causes may probably give rise to symptoms analogous to what Dr. Abercrombie has termed simple Apoplexy or Apoplexy where no enorbid appearances are discoverable after death. Pericarditis has been mentioned by M. Bournand as a cause of simple apoplexy. He mentions the case of a young man who was admitted under this case laboring under general dropsy. Twelve days after his admission he was attacked with sudden loss of consciousness; his eyeballs were turned upwards; his breathing became stridorous; his lips covered with frothy saliva; his limbs in stead of being thrown about in convulsive movements were completely paralysed. On the following day he had two or three
similar apoplectic seizures which, however did not last many minutes. He was also observed to be occasionally slightly delirious. On the fifth day after the appearance of these cerebral symptoms the tumultuous action of the heart induced M. Bouillaud to examine the condition of that organ more carefully than he had previously done when he distinctly ascertained the presence of the physical signs of pericarditis. On the following day the patient died. Dissection discovered abundant effusion of lymph into the pericardium with signs of endocarditis in the left ventricle, also recent adhesions, with some serous effusion into the right pleura, with extensive consolidation and softening of the right lung. The Brain presented no morbid appearances whatever. M. Bouillaud remarks that without the assistance of duetization
and percussion it would have been impossible in this case to have detected pericarditis in the man. He never complained of pain in the region of the heart and there was no suspicion of rheumatic inflammation in any part of the body. M. Bouilland supposed that this pericarditis had come on in the night previous to his detecting its presence and that it had been occasioned by exposure to cold, when the man was in a state of delirium went to the water closet. It however at least much more probable that the pericarditis as well as the pneumonic inflammation had already made considerable progress at the time of the first apoplectic seizure.

Hyper trophy of the left ventricle will cause the blood to be poured with unusual force and in greater quantity into the capillary vessels of the lungs.
and to gorgé and cause their
universal obstruction, the primary
effect of which will be edema
of their cellular tissue and dys-
phnea, the secondary effects, engorge-
ment of the right side of the heart
and obstruction to the return
of venous blood from the system
as large. Valvular disease of the
heart, such as contraction of
the tricuspid, pulmonic or mitral
orifice will act much more readily
as a direct obstacle to the return
of the venous blood, and cause con-
gestion of the pulmonary vessels.
right cavities of the heart Y-
If at the same time there should
exist no cause to hinder the blood
from being sent with its usual
force into the cranium, two
causes will conspire to derange
the circulations within the cranium.
Namely the direct pressure of the
arterial blood and the obstruction
to the return of the venous blood.
from the brain. But should there along with vascular disease be any degree of hypertrophy present which in fact seems to be generally the case then all the effects which I have just mentioned will be increased in proportion to the degree of force with which the blood is propelled. Dr Hope has mentioned some cases which serve well to illustrate what I have been saying. The following one not withstanding its details are defective is of great practical importance. It is a case of great hypertrophy with dilatation of the left ventricle; opacification of the aortic valve; chronic pericarditis with effusion; hemiplegia and apoplexy.

Richard Potter, 32 a cook of small stature, pale emaciated, was admitted into St. George Hospital under J. Hewett, April 8th, 1839 with hemiplegia of the left
side, mouth distorted to the right, but partial paralysis of the face, a sensation of fulness and lightness about the inferior part of the sternum, cough starting from sleep on a fit of palpitation and suffocating asthma. The dyspnœa anæsaæ pulscæ 96 fall and tolerably firm and regular. Five years before admission he had a plebeiyæ and hemiplegia of the left side which disabled him for half a year. He then resumed his work as a coote and prosecuted it until three weeks ago when he took cold and became affected with anæsaæ which he had been subject. With this account of the early history of the Patient Dr. Hope was favored by T. How, under whose care the Patient was admitted. Dr. Hope did not see him till July second, eight days after which he died in consequence of a fit of apoplexy.
Dissection there was found in the head a small coagulum of blood under the dura mater, at the vertex of the brain and three or four ounces of serum at the base. In the cavity of the pleura were upwards of three pints of serum and in the pericardium was above a pint, deeply colored with blood. The whole interior of the sac, and the surface of the heart were invested with a thick stratum of shaggy and highly vascular, reddish lymph. The left ventricle was thickened to almost double of its nearly an inch; with great dilatation of the heart. The internal membrane of the aorta was slightly corrugated by plaques, anomalous degeneration intermixed with a few calcareous scales. The edge of one of the aortic valves was encumbered with an osseous concretion as large as a piece of an elongated form, projecting into the artery and with an irregular de-
affected and sebaceous surface. In the remarks which he makes on the case he says that it demonstrates that a very considerable impediment in the aortic valves does not necessarily prevent the pulse from being full and tolerably strong and regular. The reverse of which was believed by the old writers particularly Corvisart who has been followed by Bonis and almost all other writers. The case also shows with what an extent of disease of the heart life may be maintained. Ulcerous and calcareous disease of the aorta is by frequently accompanied with hypertrophy of the left ventricle and it is natural and rational to regard the latter as a result of the obstacle to the circulation presented by the former.

I shall now go on to say a few words in regard to the frequent occurrence of cardiac disease in apoplexy and hemiplegia and also in
the relative frequency of apoplexy at different ages.

In thirty-nine patients who had died of apoplexy in the St. Mary's hospital and whose bodies were examined the following was the result. In four out of the thirty-nine the heart was found quite healthy. In eight cases more no remark is made in the journals as to its condition. We shall presume accordingly that it was quite healthy. This affords a total of twelve cases out of thirty-nine in which the heart was found in the remaining twenty-seven it was diseased. From this it will be seen that disease of the heart accompanied fatal apoplexy in no less than twenty-seven cases out of thirty-nine. That is nine thirteen or nearly three-fourths. Dr. Burrows met with thirty-four cases of apoplexy and hemiplegia twenty-three of which were found on dissection to have been
affected with disease of the heart. Mr. Burrows gives the following analysis of 132 cases collected from various authors.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Cases</th>
<th>Ixerect Heart</th>
<th>P. Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andral</td>
<td>25</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Cledinnan</td>
<td>28</td>
<td>15</td>
<td>53.3</td>
</tr>
<tr>
<td>Hope</td>
<td>39</td>
<td>27</td>
<td>69.4</td>
</tr>
<tr>
<td>Burrows</td>
<td>31</td>
<td>23</td>
<td>67.6</td>
</tr>
<tr>
<td>Guillerm.</td>
<td>6</td>
<td>4</td>
<td>66.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>132</strong></td>
<td><strong>84</strong></td>
<td><strong>63.6</strong></td>
</tr>
</tbody>
</table>

It will be seen from this table that the frequency of the coexistence of the two diseases is even much greater than what has been generally supposed and that in as great a proportion as three fifths may we expect to find heart disease in a given number of cases of apoplexy. Mr. Burrows has given another analysis of twenty-five cases recorded by Andral and thirty-four taken from his own case-books showing the relative frequency of these
cardiac lesions namely; hyper trophy of the left ventricle, valvular disease of the heart, hyper trophy with valvular lesions, or these affections of the heart combined with disease of the cerebral arteries in cases of apo plexy and sudden hemi plegia.

<table>
<thead>
<tr>
<th></th>
<th>No. of Cases</th>
<th>Heart Disease</th>
<th>Hyper trophy with Valvular Disease</th>
<th>Hyper trophy (simple)</th>
<th>Valvular Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andral</td>
<td>23</td>
<td>16</td>
<td>9</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Burrow</td>
<td>34</td>
<td>23*</td>
<td>10</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
<td>38</td>
<td>19</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

This corroborates the statement I made before that hypertrophy with valvular disease is by far the most frequent cause of apoplexy for reasons before stated.

The period of life at which apoplexy is most prone to occur comes now to be considered. Of the thirty-nine cases already quoted from Hope & dies of apoplexy between

* In one case there was simple dilatation of his cavities
birth and 40; 9 between 20 and 50; 6 between 50 and 60; 7 between 60 and 70; 11 between 70 and 80; 11 between 80 and 90; and 1 between 90 and 100; according to Dr. Hope then we have the periods of life at which apoplexy is most fatal stated to be between the ages of 40 and 50 and 70 and 80.

In 63 cases of apoplexy attended with extravasation of blood examined by M. Nochoux the ages at which death appears most frequently are between 50 and 60, 60 and 70, 70 and 80 and from what we learn from other investigations on this subject there would seem to be the ages when death most commonly occurs. Returning to Dr. Hope's table of cases let us see at which of the above periods of life disease of the heart in connection with fatal apoplexy was most common. Between birth and 100 disease of the heart was not found in any of the four fatal cases.
that occurred within those dates. Between 1,0 and 150 it occurred in 3 out of 9 a remarkable increase between 50 and 60 it occurred in 4 out of 6 a decrease between 60 and 70 it occurred in 3 out of 7 a further decrease and between 70 and 80 it occurred in 40 out of 11 another remarkable increase.

The influence of structural diseases of the heart on the brain is not confined to the production of apoplexy and hemiplegia alone but may excite functional disturbance in the brain and so give rise to cerebral congestions, epistaxis, nervous irritability and even insanity. Dr. Hope mentions an interesting case of enormous dilatation of both ventricles. During the first week that the patient was confined to the hospital he had three fits which consisted of stupor with slight convulsions and incontinence succeeded by sleep; the last attack was of three hours duration.
He sank on the eighteenth day after his admission. On examination the heart was found double its natural size and so was the liver. The brain was found healthy but contained fluid under the arachnoid membrane. The disease of the liver seemed to depend on congestion, occasioned by impeded circulation of blood through the heart and lungs. The fits no doubt were dependent on the violent determination of blood to the brain and had the patient not sunk from exhaustion his disease might probably have terminated in a fatal apoplectic seizure brought on by another fit.

J. Burrows has given the details of five cases of epistaxis brought on by cardiac disease two of which terminated fatally. The one that of a lady aged 70 who had suffered severely from profuse epistaxis. Two years afterwards she had an attack of apoplexy followed by hemiplegia in which she rapidly sank; the other
was the case of a robust man, aged 48. He had been suffering for some months from severe pain in the forehead, gid, dizziness, and pain in the chest; for this he was liesed from the arm which afforded him some temporary relief. Shortly afterwards, however, he was seized with profuse epistaxis, which continued for two days, the haemorrhage having been encouraged with the hope of relieving his headache. Notwithstanding, he was seized two days afterwards with a convulsive fit which ended in insensibility with choroiorous breathing. During the course of the same day two more fits occurred. The pupils were fixed, breathing tachypnoeic, the pulse almost imperceptible at the wrist and the insensibility complete. After the convulsive counterirritation and other remedies were employed, but without effect. The man died during the same night. On examination eighteen hours after death there was found serous effusion in the arachnoid
pic mater, and at the base of the skull is the amount of two or three ounces. The ventricles contained about an ounce of serum and there was no extravasation of blood in any part of the brain. The pericardium contained about an ounce of serum. There was a circular patch of hard, rough lymph on the apex of the heart, where the free surfaces of the pericardium were adherent. The right chambers of the heart were normal, the left auricle large, its internal lining thickened and opaque; the edge of the mitral valve thickened, but not so as to prevent its closure of the orifice; the left ventricle nearly double its normal size, and its muscular walls nearly one third thicker than usual. The aortic valves efficient but thickened at their edges. Pericarditis is another frequent cause of functional disturbance of the brain. I have already mentioned one ease of simple apoplexy evidently brought on by
This disease and Dr. Burrows has recorded sixteen cases of severe functional disturbance occasioned by acute and chronic pericarditis. Of these sixteen, eleven proved fatal and only five recovered. In four of these successful cases the diagnosis of cardiac disease was satisfactorily established in the fifth cardiac disease was only suspected. In only two of the eleven fatal cases was an affection of the heart detected during life, in one other disease of the heart was suspected, and in the remaining eight cases there was no suspicion of acute disease of the heart until it was revealed by examination after death.

We come now in the last place to consider the treatment of apoplexy and the modifications necessary when found to be coincident with disease of the heart. Almost all later authors agree in regard to their treatment of apoplexy when distinct from other diseases but as there are only
a few who have written on the subject
are in connexion with diseases
of the heart has been established we are con-
sequently furnished with limited in-
formation as to its proper treatment.
In all cases of apoplexy it ought to be examined since there are
many cases constantly occurring
where cardiac disease would never
be suspected and yet on examination
it is found to exist. When this exam-
nation is made and cardiac disease
discovered judicious treatment will
go a far way to counteract its bad
effects on the brain. On the contrary
should this examination be altogether
overlooked and a patient be ordered
by his physician to take long walks
and other brisk exercise with a view
to keep down his apoplectic fulness
of habit the consequence of such
treatment will be increased force
of the heart's action already too
powerful and determination of blood
to the head, so bringing on more
rapidly the very disease the cure of which had been the object in view. According to evidence already adduced it is in this way that the majority of those who are apparently in the enjoyment of good health are cut off. The most important part of the treatment of apoplexy consists in warding off those symptoms which we apprehend more than those which we see. Consequently, those who are predisposed to the disease should be restricted to such a regimen as may tend to obviate plethora and diminish the tendency of blood to the head. The diet should be light and spare and consist of vegetables principally with only a small amount of animal food: dressed simply and without fat. Malt and spiritsuous liquors should be altogether abstained from. Regular hours and only a small amount of sleep are often the state of the bowels secured if possible by attention to diet, while that cannot be effected the frequent use
Of mild convulsions particularly such as contain small quantities of antimony and ipecacuan as these are thought by some to be the most appropriate exercise in the open air case being taken to avoid any exposure to cold or damp. Such is the principal treatment to be adopted with those who are predisposed to apoplexy. The remedies to be employed during a fit are few and simple. Full and repeated bleedings from the arm is the first place that after this Sir Astley Coombes and others came to think there was an evident advantage to be gained from abstracting blood locally either from the temporal artery or by Cupping. Active purgatives are also of use. Mince advantage and the Croton oil seems to be the most efficient. If the patient cannot swallow it may very easily be suspended in thick gruel or muce and introduced into the stomach.
by means of an elastic gum tube. This operation should be expedited by strong purgative injections. Cold applications to the head are sometimes of great advantage. Feed water or pounded ice in a bladder or a full stream of cold water directed against the crown of the head and received in a basin held under the chin while the patient is supported in a sitting posture are the general forms in which these remedies are employed.

Such is the general mode of treatment in most cases of apoplexy when unconnected with other diseases but as we have already seen that no less than three fifths of those who die of apoplexy have diseased heart it is evident that there must in many instances a completely different mode of treatment be adopted. Bloodletting which is the remedy generally most relied on will in many such cases instead
of effecting a cure, only tends to aggr
erate the symptoms and hasten a fatal issue. The state of the pulse has been regarded by some as a suf-
ficient guide as to whether or not blood let\nning should be employed and on this point Dr. Watson in his lectures writes, "If the pulse be full or hard or thrilling as if there be obvious signs of plethora of the head blood must be abstrac\nted. You are not to refrain from bleed\ing the apoplectic patient because he is pale, if his pulse warrants it; nor may you omit taking blood if the face be turgid, although the pulse be small for that emal\nliness may depend on organic disease of the heart. On the contrary if the skin is pale and cold and the pulse feeble and flickering, you would probably secure your patient death if you withdraw from the failing heart and blood vessels a portion of their natural stimulus. Correct as these statements are the
State of the heart should always be examined as the peculiarities of the pulse are often very perplexing especially when we are looking to the state of the circulation as an indication for treatment. For example, should an examination of the heart show valvular disease to the extent of obstructing the circulation through its cavities the pulse will be a deceptive guide to the abstraction of blood. If the mitral valve be principally implicated and permit regurgitation from the left ventricle or again if the aortic valves were diseased to the extent of not only obstructing the onward current of blood but even permitting regurgitation into the ventricles during its diastole there will most probably be associated with this lesion considerable hypertrophy of the left ventricle. In the first of these cases there would be the small and irregular pulse which
might deter us from abstention of blood although required by the cerebral congestion in the second case the pulse would also be deceptive since it would be full and thrilling possibly increased action without real power. Suppose again that there is an oozing deposit about the valves of the left ventricle in the coats of the ascending aorta and in the coats of the arteries within. In this condition of the arterial system an accident at cerebral congestion may have been followed by extravasation of blood and thus have caused the most common symptoms of Apoplexy. In a case of this kind we would avoid the abstention of blood to any great extent even although the fulness and hardness of the radial pulse might have at first led us to consider such treatment necessary. I might now go on to speak of the treatment at the stage of cerebral excitement which often