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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 Monro secundus, Keilic, Abercrombie &

They conceived the cranium to be a complete sphere of bone, which is exactly filled by its contents the brain, and by which 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 diminution can occur, without the entrance of something to supply the place which had become vacant. Its contents too, are incompressible, 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
succeedingly 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 math-
ematicians or natural philosophers
upon 22,000th parts, but as physiolo-
gists and pathologists upon sensible
quantities, we may fairly proceed
upon the supposition, that the ac-
tion of the heart can produce no
change upon the quantity of fluids
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 cir-
cumstances 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 derangement 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 Apoplexy and disease 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 the 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 shew 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 there 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. Are 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. If 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 this sphere is wanting? But in children with open fontanelles and in adults who have lost part of the bones of the cranium we observe no peculiar disturbance of the functions of the brain from this gap in the walls of the imaginary sphere. But lastly the effects of gravitation on the fluid contents of the cranium, and the effects of the cupping glass.

which will often draw blood from the vessels of the dura mater causing ecchymosis there assures us that the cranium is not a perfect sphere in the sense in which it has been supposed." Startling 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 shewn in a recent review of Burrows 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

Reid
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yet strange 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 Hapd 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 sanguineous constitution itself. Notwithstanding this we find Dr. Keilic 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, Clendinning, Guil-
lemain, Burrows &c will I 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 ac-
tivity and energy of the circula-
tion the blood must consequently
be driven with greater force into
the delicate vessels at the base of
the brain and so a greater pressure
on the inner surface of those ves-
sels must take place which pres-
sure must act on the surface of
the brain. The increased force of
the circulation may as I have

formerly stated cause a derangement of the relative proportion of the venous and arterial blood. Either or both of these causes may probably give rise to symptoms analogous to what Dr Abercrombie has termed simple Apoplexy or Apoplexy where no morbid appearances are discoverable after death. Pericarditis has been mentioned by M. Bouillaud as a cause of simple apoplexy. He mentions the case of a young man who was admitted under his care 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 stertorous; his lips covered with frothy saliva; his limbs instead 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 auscultation

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. Boulland 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, in a state of delirium went to the water closet. It however appears 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.

Hypertrophy 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 so gorges and cause their
universal obstruction the primary
effect of which will be oedema
of their cellular tissue and dys-
pnoea, the secondary effect, engorge-
ment of the right side of the heart
and obstruction to the return
of venous blood from the system
at 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 &c.

If at the same time there should
exist no cause to hinder the blood
from being sent with its wonted
force into the cranium two
causes will conspire to derange
the circulation 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 valvular 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 notwithstanding its details are defective is of great practical importance. It is a case of great hypertrophy with dilatation of the left ventricle; ossification of the aortic valve; chronic pericarditis with effusion; hemiplegia and apoplexy.

Richard Porter aet 52 a cook, of small stature, pale emaciated, was admitted into St Georges Hospital under Dr Hewitt, April 8th 1829 with hemiplegia of the left

side, mouth distorted to the right, but partial paralysis of both sides of the face a sensation of fullness and tightness about the inferior part of the sternum, cough, starting from sleep in a fit of palpitation and suffocating asthmatic dyspnoea anasarca pulse 96 full and tolerably firm and regular. Two years before admission he had a palsy and hemiplegia of the left side which disabled him for half a year. He then resumed his work as a cook and prosecuted it until three weeks ago when he took cold and became affected with anasarca to which he had been subject. With this account of the early history of the patient Dr Hope was favored by Dr Hewitt 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. On

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 cavities 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 or to nearly an inch; with great dilatation of the heart. The internal membrane of the aorta was slightly corrugated by steatomatous 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 pea of an elongated form, projecting into the artery and with an irregular de-

denuded and scabrous surface In the remarks which he makes on the case he says that it demonstrated that a very considerable impediment in the aortic valves does not necessarily prevent the pulse from being full and tolerably firm and regular the reverse of which was believed by the old writers particularly Corvisart who has been followed by Louis and almost all other writers The case also shows with what an extent of disease of the heart life may be maintained. Stenomatous and calcareous disease of the aorta is so frequently accompanied with hypertrophy of the left ventricle that 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 frequency of cardiac disease in Apoplexy and Hemiplegia and also on

The relative frequency of apoplexy at different ages.

In thirty nine patients who had died of apoplexy in the St Mary-lebone Infirmary 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 sound 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 thirteenths 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.

Dr Burrows gives the following analysis of 132 cases collected from various authors

Authors	Cases	Insured Heart	P. Cent
Andral.....	25	15	60
Cleudinning...	28	15	53.5
Hope.....	39	27	69.4
Burrows....	31	23	67.6
Guillemin..	6	4	66.6
Total.....	132	84	63.6

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. Dr Burrows has given another analysis of twenty-five cases recorded by Andral and thirty-four taken from his own case-books shewing the relative frequency of these

cardiac lesions namely; hypertrophy of the left ventricle, valvular disease of the heart, hypertrophy with valvular lesions, or these affections of the heart combined with disease of the cerebral arteries in cases of apoplexy and sudden hemiplegia.

	N ^o of Cases	Heart Diseas ^d	Hypertrophy with Valvular disease	Hypertrophy (simple)	Valvular disease
Andral	25	15	9	4	2
Burrows	34	23*	10	6	6
Total	59	38	19	10	8

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 Dr Hope 11 died of apoplexy between

* In one case there was simple dilatation of the cavities

birth and 40; 9 between 40 and 50;
6 between 50 and 60; 7 between 60
and 70; 11 between 70 and 80; 1 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 at-
tended with extravasation of blood
examined by M. Rochoux the ages
at which death appears most fre-
quently are between 50 and 60
60 and 70, 70 and 80 and from
what we learn from other invest-
igations on this subject these would
seem to be the ages when death
most commonly occurs. Returning
to 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 40
disease of the heart was not found
in any of the four fatal cases

that occurred within those dates.
Between 50 and 55 it occurred in
8 out of 9 a remarkable increase
between 55 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
70 out of 11 another remarkable in-
crease.

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 ce-
rebral congestions, epistaxis, ner-
vous irritability and even insanity.
Dr Hope mentions an interesting case
of enormous dilatation of both ven-
tricles. During the first week that the
patient was confined to the hospital
he had three fits which consisted of
stupor with slight convulsions, and
stupor 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.

Dr 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 45.
He had been suffering for some months
from severe pain in the forehead, gid-
diness and pain in the chest; for this he
was bled from the arm which afford-
ed 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 con-
vulsive fit which ended in insensibil-
ity with stertorous breathing. During the
course of the same day two more fits
occurred. The pupils were fixed the
breathing stertorous the pulse almost
imperceptible at the wrist and the
insensibility complete. After the con-
vulsion 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

pia mater, and at the base of the skull to 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 natural, the left auricle large, its internal lining thickened and opaque; the edges 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 rheumatized at their edges. Pericarditis is another frequent cause of functional disturbance of the brain. I have already mentioned one case 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 coexistent 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 since its connection with diseased heart has been established we are consequently furnished with limited information as to its proper treatment.

In all cases of apoplexy the heart 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 examination 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 smart exercise with a view to keep down his apoplectic fulness of habit the consequence of such treatment will be increased force of the hearts 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 spirituous liquors should be altogether abstained from. Regular hours and only a small amount of sleep An open state of the bowels secured if possible by attention to diet, where that cannot be effected the frequent use

of mild laxatives 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 care being taken to avoid any exposure to cold or damp. Suck 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 in the first place but after this Dr Abercrombie and others seem 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 immense 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 mucilage 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 di-
rected 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.

Thus such is the general mode
of treatment in most cases of apo-
plexy 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 complete-
ly 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 aggravate the symptoms and hasten a fatal issue. The state of the pulse has been regarded by some as a sufficient guide as to whether or no blood-letting should be employed and on this point Dr Watson in his lectures writes "If the pulse be full or hard or throbbing or if there be obvious signs of plethora of the head blood must be abstracted. You are not to refrain from bleeding 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 smallness 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 ensure your patient's death if you withdraw from the failing heart and bloodvessels 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 ventricle 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 abstraction 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 possessing increased action without real power. Suppose again that there is an osseous 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 or 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 abstraction of blood to any great extent even although the fullness 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 in the stage of cerebral excitement which often