The Circulatory System in Mental Disease

by

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in Mental Disease.
The connection between the Mind and the Circulatory System is an exceedingly close one, and both in health and in disease their action and reaction upon one another can readily be observed.

The effect of such emotions as fear and shame in producing pallor and blushing through the vasomotor and vasodilator mechanism is well known, as also is the sudden throbbing of the heart produced by a position of mental strain. Conversely, all are acquainted with the pleasurable mental conditions produced by an increased flow of blood through the brain during moderate physical exercise, and with the listlessness and languor which accompanies a sluggish circulation.

In such a disorder as angina pectoris the fear of impending death is a prominent and characteristic symptom, and a most important factor in the treatment of cardiac disease is the amount of freedom from worry and anxiety which can be secured to the patient.

The relation between the two is brought out quite as fully in mental disease. The signs of an infected
circulation and its effects upon the bodily organs are well shown in the demented and chronic patients of our Asylums, while amongst the most constant morbid appearances found in the brain post-mortem are the naked eye and microscopic changes in and around the vessel walls, and the irregular hyperaemic and anaemic areas which afford evidence of altered circulatory conditions during life.

It is the object of the following pages to discuss the relationships which exist, to consider the prevalence of cardiac disorder in the insane, with the various modifications which it causes in the patient's mental and physical condition, to note important effects produced upon the circulation by insanity, and to pay attention to certain varieties of pulse associated therewith, observing for example how reduction of arterial tension in some cases may produce alleviation or even disappearance of mental symptoms.

Physical examination of patients on their admission into Asylums shows that a large proportion afford signs of heart disease and
circulatory abnormalities of all kinds. All statistics bear this out, though they vary considerably. In a recent number of the *Journal of Mental Science* the percentage of patients with heart disease admitted into different Asylums was given as varying from six to twelve. The number of those admitted into the Roxburgh District Asylum (from which I have collected my statistics) who present physical signs of heart disease is considerably higher by 18.8 per cent. This includes not merely cases of valvular disease, but those in which there was good reason to diagnose degenerative lesions.

This high figure may partly be due to the fact that we have not, as in larger city asylums, so many patients admitted, such as alcoholics, suffering from the temporary effects of the distractions of a city life, and who are at an earlier period of life and less likely to suffer from cardiac disease. The statement is fully borne out by the results of post mortem examinations conducted in that Asylum, and in the paper referred to already, although the number of patients known...
to have heart disease on admission is placed at a lower figure, it is stated, that on post mortem examination no less than 91 per cent of the cases showed structural disease of the valves or muscular substance of the heart.

These statistics refer to patients with organic disease of the heart, but an additional number are found on admission to present such modifications of the heart sounds as muffling, impurities, alterations in tone or pitch, accentuations, and reduplications, which may be referred to such dynamical causes as eratic or deficient cardiac innervation, want of muscular tone, and alterations in pressure in the vascular system. A very good instance of how such modifications may be produced even in persons perfectly sound both mentally and physically is afforded by the blowing systolic murmur audible over the aortic arch in certain persons under the influence of vigorous bodily exercise or strong emotion, conditions which are present in a marked degree in those labouring under insane excitement. Of the recent admissions, 16.7 per cent presented these modifications.
of the heart sounds, and in none of these was there any reason to suspect organic disease of the heart.

That such altered conditions of the circulatory system, organic and dynamical, form an unfavourable element in prognoses regarding the mental disease under which patients labour is fully borne out by such statistics as I have been able to collect as well as by a study of the progress of the malady in individual cases.

The proportion of recoveries amongst those of the four hundred or more patients whose heart sounds were found to be pure on auscultation was 44 per cent. Among the unrecovered are included General Paralytics, Insane, and other unfavourable cases. It may be observed that this is rather above the average for the whole country.

The proportion of recoveries, i.e. from their mental affection, of those who had organic disease of the heart was 26.7 per cent, while of those who showed decided auscultatory evidence of functional disorder of the circulatory system 26.2 per cent. recovered, and a large proportion
of these were cases in which the mental unsoundness was associated with Anaemia, and in which the murmurs present on admission disappeared on treatment concurrently with the improvement in the general health of the patient.

Although the recovery rate in the two latter classes is thus very similar, there is a marked difference in the death rate. Of those who suffered from organic cardiac disease up to the present 24.2 per cent have died, while of those who suffered from functional disorder of the Circulation only 4.5 per cent have died. This undoubtedly shows that while the bodily functions can all be tolerably well performed, and a fair measure of physical health preserved with prolongation of life, even under the disadvantages of this impaired circulation (i.e. apart from organic disease) the mental disorder is not more likely to be recovered from than if more marked structural disease of the Circulatory System were present. Indeed this is just what we might expect from a consideration of the peculiar and special
connection existing between the cortical tissue and its vascular supply in that for the proper performance of its functions the former makes very varying and sudden demands upon the latter. As Sir Wm. Broadbent remarks in his Cronian Lectures on the Pulse, "The functional activity and efficiency of the brain are even more dependent upon the blood supply than its nutrition ... so that blood which would maintain the structural integrity of the brain might be altogether unfit to minister to its functions.

A general consideration of the connection existing between Mental Disease and Circulatory disorder leads to certain conclusions which it is important to examine more in detail. These conclusions are:

1. That in certain cases disorder or disease of the circulatory system is a cause of insanity.
2. If such be present in insanity, it modifies it as to symptoms and prognosis, and naturally affects the treatment.
3. In many cases disorder of the circulatory system depends upon the mental disease, the local vascular conditions
in the brain due to morbid cell action leading to a disturbance in the whole system.

4. There is a large class of cases in which it would hardly be possible to say which is the cause and which the effect, but in which the association is marked and of far reaching importance, though it seems probable that in the majority of these the morbid action begins in the brain.

**Mental Symptoms in Heart Disease**

Among the many causes of insanity heart disease has not been assigned a very prominent position, and this is not surprising when we consider the many various causes which produce insanity, and how much depends upon the original brain constitution, but, given a predisposition to Mental Disease, there can be no doubt that the development of cardiac trouble tends to develop a mental condition which might not otherwise have occurred, and there is one especial form of insanity which is due to a very large extent to failure of the circulatory apparatus, and in which hereditary predisposition...
appears to play a less important part than usual, and that is one variety of what is known as senile insanity.

Those who suffer from cardiac disease frequently show a certain amount of irritability, dispondency, and loss of spontaneity, with hypochondriacal ideas, and loss of mental concentration, without requiring asylum treatment, or being regarded by others as showing any particular mental aberration, and these are the symptoms which we find in an exaggerated degree in those cardiac cases which are brought to asylums.

The mental symptoms which occur in valvular disease depend greatly on the point in the cardiac cycle at which the lesion produces its effect, and on the extent to which compensation has failed. Where the cardiac lesion is not very marked, and where there is no distinct failure of compensation, and the other bodily organs have not begun to suffer to any extent, e.g. in some cases of obstructive aortic disease or mitral stenosis, the mental symptoms are such as we might expect to find in an anaemic
and badly nourished brain, and resemble somewhat those present in Phthisical and other forms of insanity associated with mal-nutrition. There is a certain amount of depression present accompanied by general irritability, dullness, and suspicion, the patient imagining that he is ill treated, that plots are being laid against him, or that he is being robbed or poisoned.

This leads in some cases to frequent complaints directed against fellow patients and attendants, and occasionally to outbursts of excitement caused by the fancied wrongs. The various painful or uncomfortable sensations which happen to be present may form the basis of persistent somatic delusions, but it is more common to meet with these in mutual regurgitation.

In cases where there is less compensation, and in rather more serious forms of valvular disease, such as mitral regurgitation, where the physical condition of the patient sooner becomes impaired, and he is less inclined for effort we find similar mental symptoms, but the delusions of suspicion, though more marked, are less likely to find
outlet in outbursts of excitement than to lead to a general feeling of resentment against all and sundry. Somatice delusions are common, thus one woman imagined that there was a cat in her stomach constantly endeavoring to get out, another that her heart frequently fell down into her abdomen, and a third that electric wires passed from her heart to her head through which she felt various shocks.

In the earlier stages of failure of compensation from aortic regurgitation that form of vascular disease in which the blood supply of the brain becomes deficient, as evidenced by attacks of faintness and syncope, we often meet with a mental condition similar to that produced by a diminished supply of blood from other causes such as severe haemorrhage, in which the brain cells for a time exhibit excitation of function. There is marked restlessness shown, the patient continually moving about, often talking, and shouting, interfering with others, and showing a complete loss of self control. In more advanced cases he loses all sense of his surroundings, and becomes
delirious, this being in many cases the precursor of death, the great motor restlessness in spite of the extreme physical debility being maintained until very nearly the end.

In all cases where the mental symptoms are due to a distinct and late stage of failure of compensation in the circulatory system, whatever be the original form of cardiac disease, we have to take into account also the retarded venous return leading to a stasis of the blood current in the brain. Here the mental symptoms are those caused in addition by the presence of impure blood, which not only fails to afford nourishment for the cells but actually supplies poisonous matter.

Such an increase of backward pressure acting upon vessels which in these cases are apt to be degenerated would seem to account for the various forms of recent apoplexies often found after death. The following case exhibited typical symptoms during life, and, post mortem, innumerable minute apoplexies were found scattered throughout the brain.

On admission the patient...
was sixty-three years of age and had exhibited signs of mental deterioration for about three years. His first symptoms were loss of memory and inattention to work, leading to precocious loss and enforced retirement from business. With increasing impairment of memory he began to harbour delusions of suspicion against his wife and family. He thought that they were trying to rob and poison him, and frequently this led to his refusing food.

He complained of vague pains in the head, and his physical health deteriorated greatly. During the month preceding his admission he had become much feeble, and his mental symptoms had increased.

He was now very restless and obstinate, threatened violence to his relatives, refused his food, and was altogether unmanageable. When admitted he was in a very feeble state. Examination revealed cardiac obstruction and incompetence with dilatation of the heart. The cardiac action was hurried and feeble, compensation had evidently failed, and his vessels were atheromatous. In spite of his extremely debilitated state he could
not be kept at rest, but was continually
groping about, plucking at his clothing,
eluding bystanders, and muttering
in an incoherent way. It was im-
possible to gain his attention for more
than a few seconds at a time, and
no intelligible information could be
extracted from him.

For the first few days after admission
he showed marked motor restlessness, though
he was hardly able to stand, and usually
fell back into bed when he attempted
to leave it. He appeared to suffer
from a vague sense of uneasiness and
to be endeavouring to escape from some
haunting fear. After this he became
too feeble to move about, but was
continually trying to do so and
muttering incoherently. He became
steadily weaker, and, in spite of all
that could be done for him, died one
week after admission.

At the post mortem examination
the most interesting feature was
the remarkable number of small
haemorrhages which were found scattered
through the brain in every direction.
The great majority were about the
size of a small pin's head, but a
few were somewhat larger. They were most numerous in the right temporosphenoidal lobe. Numerous engorged vessels were noted, and several small intensely congested areas. The circle of Willis was atheromatous, but that condition was not especially evident in other vessels, though there was ample microscopic evidence of disease.

The heart was hypertrophied, the aortic sinuæe narrowed, and the cusps thickened, incompetent, and covered with nodules. This patient before admission had shown mental symptoms commonly associated with cardiac disease, advancing with the gradual failure of compensation. The last few days of his life showed the effects of cyanosis and marked back ward pressure, which eventually led to the giving way within a short period of time of innumerable small vessels, and caused the motor restlessness followed by impairment.

We have already referred to the resemblance between the mental symptoms in aortic incompetence, and some of those noted in the anaemia of severe
haemorrhage. Sir W. Broadbent* states that in his opinion a minor degree of the disturbing influence which causes convulsions causes maniacal delirium, and he instances their association in Anaemia and Brain Siphilis. This is probably similar to what occurs in the less advanced stages of Aortic Incompetence, where a less severe degree of anaemia produces mania and maniacal delirium instead of the convulsions of severe haemorrhage or of the later stages of Aortic Incompetence itself.

Two well marked cases of Status Epilepticus that I have noted were of patients who suffered from aortic incompetence, and there are notable features in connection therewith.

One patient was a young man twenty-nine years of age who had been addicted to alcohol, and who had suffered from epileptic seizures from the age of twelve, these occurring lately in groups of two or three at intervals of three or four weeks.

Mentally he was morose suspicious and irritable.

The other patient was a woman about
fifty years of age, whose first fit had occurred only a few years before, and there seems to be good reason to associate their onset with her cardiac condition. Her fits were infrequent, and on an average did not amount to more than three in each quarterly period. She was querulous, but so long as not interfered with behaved in a fairly reasonable manner. About the time of her fits she usually became irritable and obstinate. At long intervals (two or three months) she had attacks of excitement, during which for periods varying from a few minutes to half an hour she was extremely violent and impulsive, and these attacks were followed by an hour or so of mental confusion, similar to that which followed her ordinary fits. She invariably denied any knowledge of these occurrences, and there can be no doubt that they were epileptic in nature, and replaced the customary convulsive seizure.

It will thus be seen that neither of the patients suffered from anything approaching a severe form of epilepsy, yet in both the status epilepticus occurred.
Both had aortic incompetence with hypertrophied hearts and the characteristic “water-hammer” pulse.

The female patient one day, after exhibiting for two or three hours slight convulsive movements of the facial muscles on the right side, began to suffer from severe general convulsions. These occurred every five or ten minutes, and lasted rather over three days. She remained at varying periods in a comatose state for two or three hours at a time. The danger of the administration of Chloral Hydrate in Heart Disease owing to its inhibitory action upon the Cardiac Ganglia is well known, but in this case it proved most beneficial to the patient. It was given in small doses (10 to 15 grains at a time), and the effect of each dose was carefully watched. Distinct improvement was noticed after each administration. The series of fits was always broken within a quarter of an hour, they were absent for two or three hours, and on their return occurred at longer intervals, which, gradually becoming shorter, necessitated the readministration of the drug.
After six doses the convulsions ceased entirely, in two or three days the patient was out of bed, and for eight months has had no more than her usual number of fits. The Chloral evidently rendered the motor centres less susceptible to the irritating actions of the variations in blood pressure, while, by its action in dilating the cerebral vessels, probably tended to lessen these variations.

The male patient showed signs on one occasion of entering the status epilepticus, but having been prescribed purgative medicine and liberal doses of Bromide of Potassium, this was warded off. Five days afterwards he lost consciousness suddenly, went from one fit into another, and died in about an hour from the onset of serious symptoms, treatment proving of no avail.

In his brain, on post mortem examination, several intensely congested areas were seen bordered by anaemic areas.

These appearances were found in various situations, but were especially noted in the Basal Ganglia.

On microscopical examination of sections prepared by the fresh method
marked pathological changes were noted in the capillaries, which in innumerable cases had ruptured, a little heap of corpuscles being seen at the point of rupture, while beyond the attenuated vessel could be traced for some distance. These changes were well marked in the convolutions bordering the Rolandic fissure, but were seen elsewhere including the Frontal Lobe. They formed the chief pathological feature, while vacuolation of the nuclei which has so often been noted in the brains of Epileptics could hardly be said to exist, though there was undoubtedly degeneration especially of the larger cells.

In Aortic incompetence with a hypertrophied and dilated heart, each systole of the left ventricle sends an unusual quantity of blood into the vessels, and the blood is driven onwards so suddenly that stretching of the arterial coats is apt to occur with all the dangers of rupture. During diastole the cerebral vessels which are so much under the influence of the law of gravitation run a risk of being emptied. It cannot be surprising that
such variations should produce an unstable condition of the cortical cells, causing at one time maniacal delirium at another convulsions. The effect of the frequent sudden rises of pressure repeated at each ventricular systole in producing disease even of the capillary walls followed by rupture has just been described, while the case previously mentioned showed how numerous haemorrhages could be produced, which, though larger and visible to the naked eye, were still minute.

The change in the mental symptoms which may be produced by a different phase of a cardiac disorder is well illustrated by the following case.

The patient was an elderly man in whose family there was a hereditary predisposition to insanity, and who on admission was somewhat depressed and moody, kept apart from others as much as possible, seemed suspicious of their intentions, and could not be got to converse. Physical examination of the heart revealed mitral regurgitation and slight dilatation of the left ventricle with increased transverse cardiac dulness.
His pulse was 76 per minute, and rather weak and irregular. Under tonic treatment both his mental and cardiac condition improved, and he was allowed a considerable amount of liberty. He took advantage of this, and one day disappeared from the Asylum about five months after admission.

He walked to his home, about twenty miles off, and arrived there much exhausted by a feat which he certainly had not attempted for many years.

He was sent back to the Asylum, when it was found that his heart had suffered seriously from the strain. There was increased dilatation, great irregularity of the pulse, which was very feeble, and varied in rate between 120 and 140 per minute, and the usual physical signs of cardiac failure. His face was dusky, his feet edematous, and he showed marked breathlessness on the least exertion.

His mental condition was now entirely changed; he talked almost incessantly, and in an incoherent manner, instead of avoiding others he was continually button-holing them, and making himself as officious as possible. It was
sent to bed, though it was a very difficult matter to keep him there, and Digitalis was prescribed with a nourishing diet. His great restlessness retarded the beneficial effects of treatment, but he gradually improved both mentally and physically, so that in about ten weeks he was able to do a fair day's work in the garden, at which employment he has continued since, now for a period of nearly three years.

Before being sent out to work all his restlessness and talkativeness had dis. appeared, and he had become a quiet civil well behaved old man in a state of mild dementia.

It appears from the foregoing consideration of the mental symptoms that we cannot say that our cardiac cases suffer either from pure Mania or pure Melancholia. Those in which excitement was a fairly marked feature were usually classified as cases of Mania, but any mental exacerbation present was seldom in the direction of joy or self satisfaction, but was always shown in anger against fancied wrongs. While the Melancholics and Maniacal cases were nearly equal.
Of those who had cardiac murmurs on auscultation the proportion was 55.1 per cent.

While the prognosis of senile insanity is rather unfavourable, when the disorder is associated with heart disease the prognosis is much more unfavourable. For although there is not such a great difference between the recovery rate of the two classes as there is at an earlier stage of life, the disproportion between the death rates is very great. Of senile cardiac cases 18.5 per cent recovered from their insanity, of the other senile cases 22.7 per cent recovered. Of the former class there have died up to the present no less than 40.7 per cent while of those senile cases whose hearts gave no evidence of murmurs only 4.8 per cent have died, so that from the latter class must chiefly be drawn the senile elements who form a chronic residue.

The changes in the arterioles which occur as old age approaches can only be regarded as fulfilling a physiological law. The loss of elasticity however in the walls which prevents a free onward movement of the blood throws a strain
upon the heart which by weakening it still further impairs the circulation, long continued worry and anxiety with their depressing effect upon that organ being in another factor in the production of morbid mentalisation. The disappearance of capillaries which has been referred to by Renke to the intermittent blood flow caused by the loss of elasticity in the arterioles takes place in the brain as in other organs, and the result is a low nutritional condition of the cerebral cortex.

If the condition be not further advanced we find the mildest and most curable form of senile insanity, viz. Melancholia. The depression is not usually profound, and there is usually a certain amount of mental enfeeblement present, so that many of the patients who recover are sent home in a condition of mild senility. The condition of the vessel coats has not been repaired, but if the patient lead a quiet life and be kept from the worries which depressed his heart, that organ is able to keep up sufficient supply of nutriment to the brain to enable the patient to live the rest of his...
life in a fairly normal manner.

Instead of melancholia we may have mania, and the conditions which bring about the latter form appear to depend greatly upon the original brain constitution and the patient's family history. A man who on growing old suffers from an attack of mild melancholia owing to a low nutritional condition of his cortex need not have had any particular hereditary tendency to insanity. It is the senile maniae with his restlessness, garrulosity, mischievous destructive and indecent habits, who comes of a neurotic or insane stock. Such a family tendency implies deficient controlling power, and so when insanity occurs, it is more likely to issue in mental excitement and motor restlessness. Like the melancholic variety this may also pass off under treatment and leave the patient in a condition of normal senility.

The unrecovered of both classes often pass into a condition of senile dementia. In speaking of senile melancholia as the mildest form of the insanity of old age, we do not infer that every case that begins with depression is
necesarily of favourable prognosis, for this just as in other forms of mental disease may only be a premonitory symptom, and the gravest forms of mental disease may soon make themselves evident by other signs. Indeed depression is usually the first symptom of atrophy of the brain and very often of localised softenings due to thrombosis or embolism, or even haemorrhage. These of course are the results of more advanced vascular disease than we have been considering, and naturally the prognosis is very unfavourable. Atrophy may be either the result of actual obstruction of the blood supply to a part through thrombosis or embolism, or of a prolonged lowering of that supply to the brain as a whole as a result of an impaired circulation due to loss of elasticity in the vessel walls and enfeebled cardiac action.

The probability is, that the unrecovered cases of Senile
insanity that survive, that is to say the chronic residue, owe their mental condition to these forms of brain disease. They are likely to live considerably longer than the type usually to be described, though at any time life may speedily be brought to an end owing to the exhaustion produced upon their feeble frames by continued excitement, with want of sleep and restlessness at night, or to complications which may set in. Further, haemorrhages are apt to occur in an atrophied brain of this kind, and in a brain in which a softening has once formed, others are extremely likely to follow.

A considerable number of senile cases, however, in whom the general health becomes improved live on as the restless, noisy, troublesome senile maniacs of our asylums, affording a further example of the effect upon mental function of an impaired circulation, which may however be sufficient for the other functions of life.
Senile cases with heart disease form a distinct variety. These are the patients whose insanity is of a very pronounced type, in many cases running a rapid course and bringing the patient to his grave within a period varying from a few days to three or four weeks after the onset of acute symptoms, and in whom the mental disorder has usually been regarded as the sign of a general and violent breaking up of the system. They form a very important class, as relatives are often greatly distressed that their aged ones should depart from life in such a state, and to the physician they are a source of great anxiety on account of the risk of injury which their helplessness entails, and the obstacles which they offer to treatment.

The usual history is that for some time before admission the patient has been forgetful, irritable, suspicious, and sleepless, that the symptoms have increased until he has become too restless to be managed at home, and has even displayed violence. On admission, his tortuous vessels, tremulous limbs, par tic speech
often indicating localized softened
ings in the brain, the cardiac murmurs,
and the dilated, failing heart, with
irregular pulse are noted. He has
usually little idea of his surroundings,
can give no account of himself, and
appears to comprehend scarcely any-
thing said to him. At nights he
will not remain in bed, gropes about
his room, and usually sustains frequent
falls. He seems in a vague way to
suffer from hallucinations, and is
quite incoherent in speech. He may
show slight convulsions and paralyses.
has some difficulty in swallowing, and
generally refuses his food. Death
usually ends the story in two or three
weeks, the restlessness, continuing until
unconsciousness occurs.

Such are the symptoms of Senile
Insanity which usually accompany
a diseased heart when compensation
fails. As we have already seen
the death rate in this variety is
very high (40-7). About the
same proportion of those noted re-
mained as chronic patients, while
nearly one fifth recovered sufficiently
to be sent home.
Reference has already been made to the treatment adopted in various cases which have been described, and little further need be added in this connection. If one concludes that the patient's mental symptoms are due to disorder of the heart he has merely to modify the treatment of insanity in accordance with the principles of cardiac therapeutics. If the cardiac failure is extreme naturally rest in bed is indicated. If the patient's physical condition permit, then moderate outdoor exercise, which is found so beneficial in ordinary forms of insanity, will be found to have as good an effect upon the heart as upon the mental condition, while a certain amount of rest in bed during the day may with advantage be allowed him. Such cardiac tonics as Digitalis and Strophanthus were used with benefit in many cases, while mental improvement was also seen in many under the administration of Iron, Arsenie and the mineral acids, Struphmine being given to certain of those patients who had mitral
incompetence associated with mental depression, though it was withheld from cases of excitement. Nourishing food and attention to the excretory organs always formed part of the treatment. Hypnotics, sedatives, and motor depressants were not given unless absolutely necessary, and then it was found that in suitable cases, under careful observation, they were always administered with safety. The treatment of senile patients was more difficult, but the same principles were adopted. Whenever they could be out of doors they were prescribed moderate exercise, and the good effect of this upon their feeble irregular hearts was often surprising, improvement in the mental symptoms often following. In a great many of these serious forms however in which the mental disorder depended upon cardiac failure and a general "breaking up" of the system, no treatment proved of any use, and the patient had to be kept at rest as much as possible, usually in a room with a padded floor, to obviate the risk of his injuring himself.
Effects of Mental Disease upon the Circulation.

So far we have been considering cases in which the mental symptoms depend on defects in the circulation, but, while such defect is only one of the many causes of insanity, we have the converse occurring to an even greater degree, and find that the immediate effect of mental disease is to produce marked dynamical alterations in the circulation, and if it persist then distinct organic changes ensue throughout the vascular system.

The effect of increased activity of the cortical cells in producing a rapid flow of blood through the brain has been abundantly proved by various observations, such as those made with the Plethysmograph of Mosso, where it is shown by the withdrawal of water from the graduated vessel how blood is abstracted from the vessels of the arm during intellectual activity. (In the experiment which I witnessed an attempt to recall the origin, insertion, and relations
of the Glutus Maximus showed this very well), by the bulging of the brain which has been seen to occur through a trephine opening, and by the rise of temperature on one side of the head which has been recorded as taking place during similar mental effort and measured by the apparatus of Dr. Milne Murray.

Indeed this is just what holds good throughout the body, that an organ requires an increased blood supply during functional activity. Where, as in some forms of insanity, this activity is exaggerated and prolonged beyond normal limits, it is not surprising that the general circulation should show some modifications, especially as the cardiac and vasomotor centres are sure to be disturbed by the abnormal processes going on in the cortex, while in many cases we have to take into account as an accompaniment the excessive physical exertions of the patient.

It cannot be doubted that in ordinary cases of Idiopathie
Insanity, the cortical cells are primarily at fault, and that the vascular manifestations are of the nature of a reaction, and that if the normal working of the cells could be restored the vascular condition would subside, and this is what must occur before health can be restored, but there is undoubtedly a limit to this, and once the brain has lost this control over the circulation a state of matters has been established which militates strongly against recovery.

The cases to which reference has been made as exhibiting on admission signs of dynamical cardiac disturbance with a comparatively low mental recovery rate afford proof of the serious result of this loss of balance between the cortex and its blood supply. If we consider for instance cases in which the heart sounds were found to be impure, we know that such impurities often indicate conditions which in course of time may give rise to actual murmurs, and doubtless this is the reason why such a
very large proportion of hearts examined post mortem in asylums show signs of organic change, while a much smaller number of patients on admission are diagnosed as having heart disease. In fact, in the case of patients suffering from frequent attacks of excitement we can often note these impurities gradually giving place to actual murmurs.

In recent insanity we often observe the process going on with more or less rapidity. One of the most serious complications we have to guard against for instance in acute delirious mania is the heart failure which so often supervenes. This may occur with the greatest suddenness, and in other forms of insanity also in which there may be some organic disease of the heart, though not advanced, no great motor excitement is required to bring about a fatal issue. The latter was well illustrated in the case of an early General Paralytic who died suddenly in Melrose Asylum.
His mental disorder was said to have existed for a fortnight before admission. His condition was one of great exaltation, he was extremely well satisfied with himself, full of ambitious schemes, and lavish in his promises, but there was none of the purposeless motor excitement or acutely maniacal condition often met with in the first stage of General Paralysis, and he followed his occupation, that of a millworker, until the day before his admission. He was a muscular well nourished man, Auscultation revealed aortic stenosis, but the pulse was regular and strong, and there appeared to be no marked impairment of circulation. Compensation in fact appeared to be fully established. For the first twenty four hours after admission he was rather restless and obstinate, and moved about his room a good deal during that night, but afterwards his chief physical exertion was talking and singing. He spent a considerable amount of time out of doors, and lay among
the day sunning himself, making seditious remarks, and boasting of his powers. This mental excitement eventually told upon him, and one morning, nineteen days after admission, he complained of feeling faint, and though placed absolutely at rest and freely stimulated, he died in less than half an hour.

In some cases of acute excitement when the patient is at or beyond middle life, it is evident that sudden dilatation of the heart occurs, and the condition is one of great gravity, threatening the patient's life for the time being and his mental recovery in the future.

An example of this was afforded by a female patient aged forty-six who was admitted labouring under acute mania and in whom mental symptoms had only existed for about a fortnight. For about six weeks before that however she had been unduly suspicious of her relatives, had shown a tendency to refuse food, thinking it poisoned, and had at times been confused.
and forgetful. She had also occasionally complained of palpitation. On admission her cardiac action was rapid and slightly irregular. The heart presented no other abnormality. Her mental condition was one of great excitement. She was quite incoherent, her attention could not be commanded, and she continued to run about shouting and singing. When exhausted she would sit down or lie with her eyes closed and an expression of rapture on her face, muttering prayers for strength and guidance, and then shortly resume her excitement. She got regular moderate outdoor exercise, and when within doors, endeavours were made to get her to rest as much as possible. Twice during the first week, after the administration of Sulphonal in thirty grain doses, she appeared to be settling down, but collapsed, and a fortnight after admission, having been extremely excited for two days, she became suddenly collapsed, lying motionless, uttering no sound, and wearing a look of extreme distress and anxiety.
Her pulse was feeble, short, and fluttering, and ranged from 130 to 150 per minute; the respiration was sighing, and dilatation of the heart was found to have occurred, with the development of a mitral systolic murmur.

She remained in this serious condition for four days, when, having gradually renewed her vigour under treatment by rest, Strophanthus, followed by Digitalis, and suitable diet, she again became excited, left her bed, and resumed her previous acute condition. This lasted for about ten days, when threatened cardiac failure again occurred accompanied by oedema of the legs and feet, the conditions being less serious than formerly. Though she remained in bed, she gave evidence of being very delusional and incoherent. From this time her physical condition gradually improved, but, though she became less noisy, she showed no other improvement mentally. The circulatory system had evidently become permanently impaired, and a haematoma occurring in the right
ear less than three months from the beginning of the attack added another reason for unfavourable prognosis.

In another female patient admitted about the same time certain similar features were observed. Though she had shown symptoms of mental disorder for about three months, she had not become acutely excited until a few days before admission. Her cardiac action was rather weak. For five or six days she improved slightly, and then an attack of intense excitement followed, and as a result of this in a few days cardiac failure supervened, though not so marked as in the last case. Under similar treatment her physical condition greatly improved, and she was able to be employed at first in household work and afterwards in the Laundry, but although her excitement had disappeared, her mental condition showed great impairment.
and recovery is hardly to be expected. Less than three weeks after her acute attack she was found to have a haematoma on one ear.

The occurrence of haematoma Anris in both of these cases is interesting. It has for long been regarded as an unfavourable sign in the prognosis of insanity because it was held to indicate grave disturbances in certain branches of those vessels which supply the brain, and here we have it associated with other forms of circulatory disorder which we have seen must also be regarded as of unfavourable import. Neither of the patients was at an age at which degenerations are usually to be expected, though perhaps there was reason to believe that their vessel walls were not in a perfectly sound state, thus illustrating the early onset of degenerative change in Mental Disease.

The recent researches of Dr. Middlemass and Robertson have
shown the presence of cystic degeneration in the auricular cartilage in cases of haematoma auris, but, apart from injury which is not at all necessary for its production, there can be no doubt that the exciting cause of the insane ear is found in the extreme and rapid changes of pressure which take place in the circulatory system of the insane, and further, if we seek a cause for the degeneration of cartilage, I think that an important factor is found in the disturbance of nutrition produced by circulatory disorder. Haemorrhages which occur in the insane in other regions of the body have also been ascribed to arterial degeneration* among other causes, but undoubtedly cases do occur in which there is no reason to suspect the existence of degeneration. A case which I saw some time ago, in which an attack of acute excitement was accompanied by echymoses is of interest.
The patient was a woman aged thirty seven who looked considerably younger. She had had three previous attacks of acute mania and her longest residence in the Asylum had been less than four months. There was a strong hereditary tendency to mental disease. She was a stout, well-built, muscular country woman of ruddy complexion and unusually delicate skin. The cardiac action was rapid and a faint murmur accompanied the first sound in the mitral area.

On admission, three days after the attack began, she was in a condition of great excitement, running about, dancing, shouting, and gesticulating. She was quite incoherent, and paid little attention to what was said to her. A few small bruises were present about the elbows and knees, but these had all disappeared in the course of a few days.

During the week after admission, though at times it seemed as if her excitement were about to moderate on the whole it gradually increased. Occasional doses of Sulphonial or draughts of Chloral and Bromide...
of Potassium secured her some sleep, and she remained quieter for the rest of the night when awake. For a large part of each day she was out of doors under special care. She spent most of the time running up and down, tossing her arms and hair about. When tired of this she lay on the ground with her limbs spread out, calling out in a state of religious frenzy that she was being crucified and stoned. One evening a week after admission her excitement during the day having been at its height, she was found to be covered with ecchymoses. These must all have appeared about the same time, and must have been quite recent as she had received frequent bathing, and had they existed before they could not have escaped notice.

They were most numerous on the inner aspect of the thighs, a few were visible below the knee and also on the outer aspect of the thighs. They were well marked on the front and inner aspect of the left arm, the chest, and back of the shoulders, with a few on the right arm.
During the next few days they underwent the changes usual in extravasated blood, and gradually disappeared.

I think that there can be no doubt that the cause of rupture and extravasation here was the hyperemic condition of the skin due partly to vasomotor paralysis or vas-dilator action and partly to the frequent and violent muscular action. There was no arterial degeneration and no recognizable change in the blood was found on examination.

The extreme congestion of the cuts was shown by two other circumstances which occurred. Shortly before the spots were discovered the patient in her excitement had bitten her thumb. The bleeding was so profuse that the nurses thought that she had bitten off a portion, but upon examination only a comparatively slight injury was found. Just at the time when the ecchymoses were first seen her excitement was so great that it was thought advisable to give her a hypodermic injection, and, though this was done with the usual precautions, it was found that a certain amount of bleeding took place.
The ecchymoses, which occurred on parts considerably protected, were evidently not due to injury, and besides she had been under the constant observation of nurses who asserted that she had not received any injury.

This patient made a good recovery. Though she continued in a manic condition for some time, she at no subsequent period was so excited and when gradual improvement had taken place she was discharged after a residence of three and a half months.

In the following case a remarkable number of consecutive haematomata of a more extensive character occurred, and this case may be taken to illustrate some probable vascular degeneration as a contributing case.

On admission the patient was Case of J.W. fifty-eight years of age, and little was known of his previous history, except that he had led a wandering and irreligious life. He was rambling and incoherent in speech, and during the first few weeks was subject to attacks of excitement, which
lasted about two days at a time, and in which he danced about, singing and reciting, and attempting to remove his clothing. A Systolic murmur was audible in the mitral area, the radial artery was rather rigid but the pulse, unless during his periods of excitement, was fairly regular.

Seven weeks after his admission a haematoma was observed in connection with the left ear. This was treated in the usual manner with blistering fluid, and began to subside. He now became more excited, and in a week the right ear showed a haematoma, which was similarly treated. A fortnight later, during a period of excitement, a large swelling appeared over the left scapula extending downwards over the ribs, and his temperature was found to be slightly elevated. As the swelling gave signs of fluctuation, it was punctured with a trocar and cannula, and twenty seven ounces of blood stained serum drawn off. Two days later twelve ounces were removed in a similar way, and the swelling subsided, pressure having been applied. No broken ribs
were found, no injury to the scapula, and no superficial bruising until a few days after the appearance of the tumour, when slight discoloration was noted, so that had any injury been sustained it must have been very slight.

In little more than a week a tumour which was diagnosed as a haematoma appeared over the left masseter, and subsided in a few days without special treatment.

Ten days later a similar swelling formed in the parotid region, and in a fortnight, before this had quite disappeared, a second large tumour formed over the masseter. These latter were rather firm in consistency, iodine was applied externally to both and they gradually disappeared. Thus during a period of eight weeks six separate haematomata were found with this patient, all but one upon various parts of the head.

They all occurred during his spurs of excitement, and were formed with great rapidity. There was never any distinct sign of injury, no inflammation was present, they
appeared not to cause any pain, and, with the exception of those connected with the ears which produced a slight deformity, left no trace of their existence. It is nearly nine months since the last appeared, and nothing further of this nature has been observed. He is now a chronic inmate of the asylum, but rarely has his attacks of excitement, which are much milder when they do occur.

In the paper in the Journal of Mental Science already referred to the opinion of Unna is quoted that haemorrhages into the skin are due to dilatation of the cutaneous arterioles with spasm of the veins. In the two patients whose cases have just been described there was undoubted arterial dilatation and, though spasm of the veins may be difficult to prove, still it was noted that a mitral systolic murmur was present in both, which, along with the loud shouting in which they both indulged, would tend to cause frequent variations of pressure.
Local vaso-motor and vaso-inhibitory phenomena are unusually common in the insane, who exhibit frequently various forms of erythema and urtica. Frequently we have noticed a patient develop suddenly great oedema and redness of some part of the body without rise of temperature, and have seen the condition subside again in a couple of hours. The face appears to be more commonly affected than any other part of the body.

The effect of changes in the mental condition in producing alterations in the circulation of particular areas of the body, or the association of these mental and physical conditions, is shown in an interesting way in a patient whom I have had the opportunity of observing.

This woman has been an asylum patient for many years. During the first few years of her residence she is reported to have had long periods of comparative sanity during which though timid shy and reserved she used to occupy herself usefully was neat and tidy in person and sensible in conversation.
For more than a year previous
to the time at which I made ob-
servations upon her, these intervals
had become of much briefer duration,
and had been occurring much less
frequently. During her states
of abberation she is entirely changed,
does no work of any sort, refuses
her food, tears her clothing, and
makes herself as untidy as possible.
For long stretches of time she
stands in a corner, looking as if
on the point of an outbreak of
excitement. If spoken to, she
often replies with a flood of in-
coherent language, and she is liable
to attacks of impulsiveness, during
which she makes a sudden assault
upon some article of furniture, or
endeavours to smash a window.
Whenever these mental relapses
occur her hands show characteristic
signs of Raynaud's Disease.
At first they are usually blanched
and cold to the touch—signs of
local anaemia due to contracted
arterioles,—and the radial artery is
found to be small. But venous
congestion soon ensues and the
Case of S.A.

The first tracing was taken during one of her periods of comparative sanity, the second, showing increase of tension, at the beginning of a mental relapse.

The third, taken during a relapse, shows the marked contraction of the radial artery which existed on the right side.

The fourth was taken at the same time as the third and is from the left radial artery. The appearances described in the text were always best marked in the right hand.
hands become livid, mottled, and raised, and swollen. Very frequently patches somewhat resembling those found in urticaria, but of a more glistening appearance, are seen upon the dorsum of the hands, and even slight blisters have occurred, but there has never been any ulceration or sign of gangrene.

This condition is seen during the warmest days of summer, and is practically unaffected by exercise. During the remission of the mental symptoms the hands are found to resume a normal appearance.

The patient is rather over forty years of age, and her family history shows a hereditary predisposition to insanity. It has been found impossible to associate her mental manifestations with her catamnetal periods. The duration of her attacks has varied considerably, from three weeks up to ten weeks, and, during the time I have observed her, the periods of remission have varied from one to three or four weeks. During her longest period of excitement, which occurred in summer, she received Quinine and Perchloride of Iron, with
considerable benefit to her hands.
To calm her excitement various drugs have been tried, including antipyrin, sulphonal, chloral, and bromide of potassium. They all tended to render her less unruly during their administration, but had no effect in cutting short the attack.

Observations made recently upon her radial artery have shown the following. Her pulse tension is very high. At or just before her periods of mental aberration her radial artery becomes more contracted, and the tension rises. During her attacks the contraction of the radial artery is extreme. The accompanying sphygmographic tracings illustrate these facts.

The onset and termination of her attacks were always pretty sharply defined, so that one could almost confidently say, on observing certain preliminary signs, that next day her attack would be fully established, or, in the other case, that next day she would be well.

Recently it was decided to make an attempt at treatment by reducing
the arterial tension. Accordingly, as soon as the showed signs of the commencement of one attack, Hydrag: Subchlor: (6 gr.) was administered, with a view also to having the bowels cleared out. For fully a week there was a diminution of the symptoms, and then they began to appear again. Another dose was prescribed, but through a misunderstanding was not given, and in a couple of days the attack was at its height.

In order to try and relax the arteries and soothe the nervous excitement the following was prescribed: Potass: Sodi: gr. v. Potass: Bromid: gr. x. Tymet: Belladonn: Mv. in water thrice daily, and in three or four days she was back at her work with the convalescents. This result of treatment was very encouraging, but, having lost further opportunity of observing the patient, I have been unable to try its further effect.
The Pulse in Mental Disease

Since such marked disturbances are produced in the circulation by or in connection with various mental conditions, it is to be expected that an examination of the pulse indication should afford an analysis of certain of the changes which occur, whether these are the effect of the mental disease upon the heart and general physical condition, or whether they are alterations in blood pressure produced by nervous influences acting upon the vessels.

Attention has been paid to the subject by different observers, and various characteristic states of the pulse have been shown to accompany various forms of mental disease. In many cases, doubtless the particular variety of the pulse depends to a great extent on the patient's general condition, or, as in the case of acute excitement, upon the physical exertion which the patient undergoes, but it seems certain that definite
Forms of mental disease have their typical pulse. It is of considerable advantage indeed to study variations in the condition of the circulation in individual patients, as we find them in our asylums, who show alterations in their mental condition at different times.

Such a study may afford indications as to the treatment of undesirable symptoms as they arise, or even as to measures to be taken to ward off relapses.

Among the various alterations in blood pressure connected with mental conditions, the one to which we may now refer is the increase of tension associated with the onset of a stuporose condition.

In the case of a certain Case of W.O. general paralytic, the connection of stupor with high pulse tension and with a physical condition which threatened to put a speedy end to his life was very marked, as also was the great improvement mental and physical which followed.
He had shown symptoms of insanity for two years and a half previous to the onset of the stuporose symptoms under review and during that time at the earnest solicitation of his friends he had been allowed a period of trial at home but had been so irritable, headstrong and restless that he had to be sent back. On readmission he was in the familiar exalted troublesome stage of general paralysis had lost all self respect and was indecent, erotic and disreputable in his habits. He spent his days in concocting ambitious schemes was pugnacious and at times very difficult to manage, and frequently noisy at night. His tongue was tremulous, the speech hesitating and accompanied by twitching of the facial muscles, the pupils somewhat contracted and the knee jerks exaggerated.

To soothe his excitement he received Sulphonial and was always calmed by it, but no real improvement was noticed in his condition.
The first important change was the onset of a stuporose condition, in which he wore a fixed expression of face as if he dreaded the onset of some great evil, would stand in one position for hours and was speechless, obstinate, and resistive. (Shortly before this he had shown similar signs for some days, but an attack of Influenza with high temperature had restored him to his noisy, excited, and frequently violent condition — an illustration of the effect often noted upon stuporose patients of a rise of temperature.) In the state of stupor his bodily condition became much impaired, he was wretchedly thin, and remained in bed. Severe convulsions then occurred. They were at first confined to, and affected the whole of the left side and when they became general were always more marked on that side. The contractures continued for about four hours, and during that time he had several exacerbations with loss of consciousness. His pulse gave
evidence of marked tension, and
croton oil was administered. A few
hours afterwards he answered questions
addressed to him, though he had not
done so for weeks. Bromide and
iodide of potassium were administered,
and means were taken to reduce
tension. He improved to some ex-
tent mentally, and was able after
some time to be out of bed for
several hours daily. About two
months after the first occasion he
again had a return of the con-
vulsive seizures. The left side
was chiefly affected. Every
three or four seconds spasmodic
contraction of the muscles was ob-
erved, causing jerking of the leg
and arm and of the head to the
left side. These continued for
five days, ceasing only during a
few hours, and in addition he had
several attacks of severe general
convulsions. Motor power was
much impaired, to the extent for
some time of absolute paralysia,
and sensation was disordered in
the affected parts. His pulse
was one of high tension, and the
Case of W. O.

The first tracing was taken during a period in which his mental condition was at its best.

The second was taken on one occasion when he showed signs of becoming stupor.

The attack passed off under treatment.

The third was taken during an attack of stupor which was followed by convulsions.

The third and fourth were taken within a few minutes of one another and without removal of the sphygmograph. The increased jerking of the needle was the first indication of the approach of a convolution which soon followed.
the immediate administration of
Calomel after a convulsive seizure
undoubtedly cut short the attack,
and prevented it assuming serious
proportions. On one or two
occasions when he became rather
moody the inhalation of Nitrite
of Amyl was tried, the arterial
tension was reduced, and a
distinct change for the better
was observed in his mental condition.
The attached tracings are
illustrations of the fact that
even when he was at his best
his pulse was one of more than
normal tension, and that this
was considerably increased when a
stuporose state supervened.
If reduction were not accomplished
convulsions occurred. The last
tracing shows the effect of the
motor discharge upon the circulation
while the sphygmograph was
upon his wrist, and just after
a tracing showing high tension
had been taken, the indicator
was observed to jerk violently,
but the patient was lying perfectly
still, and to outward appearance
had not changed in the least.

A few seconds afterwards, deviation of the head and eyes to the left was observed, and severe general convulsions followed, so that the great cardiac excitement was the first evidence of the general motor disturbance.

Dr. Bevan Lewis states that general widespread convulsions "usher in the gravest seductions, often leaving the subject a complete mental wreck" and further (quoting Newcombe) that in twenty-four out of sixty cases death occurred within a month of the attack, so that the case described must be regarded as a remarkable exception to the general rule.

Some time after the above report of the patient's case was prepared he suffered from an apoplecticiform seizure, became entirely paralyzed on the left side, and died in a few weeks. His wife absolutely refused to allow a post mortem examination to be made.

Given the formation of a false membrane under the
dura mater, such convulsive and paralytic symptoms as the patient exhibited may probably be explained by a reference to the haemorrhages which are known to occur in this connection, and to which a predisposition would be established by the high blood pressure. Many theories have been formulated to explain the pathology of haematoma of the dura mater or so called Pachymeningitis haemorrhagica, into a discussion of which we need hardly enter.

Recent researches by Drs. Middlemass and W. F. Robertson have led them to the conclusion that such membranes are formed from the blood which is extravasated from vessels which are undergoing a hyaline degeneration, and also from new capillaries which are formed to take their place, the formation of granulation tissue being a step in the process.

It is usually stated that the formation of these membranes is not accompanied by any definite symptoms, but I cannot refrain
false membrane, and formed the ordinary subdural haematoma.

The first two patients were melancholics with high vascular tension. There was a notable resemblance between the symptoms exhibited by these patients and an interesting similarity in the conditions found after death.

It always seemed to me that the convulsive symptoms exhibited by the general paralytic (W.O.) with the stuporous attacks, whose case has just been recorded, were due to a similar pathological condition, and it is to be regretted that permission could not be obtained for an autopsy in his case.

A further example of the association of high pulse tension with stupor is afforded by one chronic patient a woman aged fifty-eight in whom stuporous attacks, which used to last for a few weeks when they occurred and were always accompanied by high pulse tension, have been on various occasions.
apparently checked by the administration of mercurials. She is as a rule mildly cheerful, and a moderately useful needlewoman, a little enigmatic in behaviour at times, but fairly intelligent, and presenting no special features. In her stuporous condition she always became dazed, and her expression was absolutely blank. It has not been discovered whether during this period she was under the influence of any delusion, and she has never afforded any information upon the subject after recovery. Whenever interfered with she was very resistive, and this has always prevented the possibility of a sphygmogram being obtained which could possibly be regarded as of any value.

In a young man, who has had several attacks of acute mania, and whose condition has now become one of mild chronic insanity, with exalted notions, a stuporous attack at one time supervened, and his pulse tension was found to be remarkably high. His radial artery was so contracted that a
superficial examination might have led one to believe that the pulse was feeble, had it not been that it was found to be practically incompressible, and that pressure increased the force of the beat.

The administration of stramonium oil or caudal, which lowered the tension, always brightened him up a little, and he steadily though slowly improved coincident with a reduction of the high vascular tension.

The general result of increased blood pressure throughout the system is a slowing of the current, and, on account of the special physical conditions under which the cerebral circulation is carried out, the effect is not less likely to be marked in the brain than elsewhere. Such a condition of stasis will throw upon the lymphatic channels a task which they may perhaps not be able fully to carry out, and that such may be the connecting link between the high vascular tension and the mental phenomena of stuporose states is further
borne out by the general cerebral sedema which has been shown to exist in the brains of those dying in a state of stupor.

* Et toc demagogica on Stupidity.

The Pulse in other forms of Insanity.

Melancholia, (which in one variety is also one of the forms of Stupor — ex. Melancholia Attonita), is also frequently associated with a pulse of high tension, and is said by Sir WM. Broadbent to be in many cases due to this condition of the circulation, the obstruction to the onward flow of the blood caused by the contracted vessels leading to a failure of the cardiac energy and a general sluggishness of the circulation, and he recommends the lowering of tension to be adopted as the basis of treatment, but there are other varieties of the pulse associated with melancholia, and we often meet with one of low tension.
Tracings from two cases of Melancholia showing very different states of the circulation. The first was a woman about 55 years of age, the second a young woman aged 25.

Characteristic low tension pulse in case of Simple Mania.

Low tension pulse from case of Epilepsy liable to attacks of maniacal excitement.

Pulse tracing taken during epileptic coma. Patient was in a very critical condition but recovered.
If there be a characteristic pulse in Mania it is one of low tension, and on recovery the tension is found to improve, but probably the lowness is due to a great extent to the physical exertion which the patient undergoes, and to the exhaustion which results, while the increase is due to the quieter behaviour of the patient and to the improvement in the general health.

Further were the pulse tension high in a person who became maniacal, though it would probably be somewhat reduced, still it would...
not necessarily come under the
category of a low tension pulse.
Reference was made in the section
upon ecchymoses to the relaxation
of the arteries which occurs in acute
excitement.

We have already seen how
in one case of general paralysis
the pulse tension was high, and
referred to the risk of convulsions
which was connected with it. In
a disease like this where the
symptoms vary from time to time
the condition of the pulse varies
also. The general tendency
in the earlier stages is to an
increase of tension, but in the later
stages naturally, this characteristic
feature is lost.

True Epilepsy with the insanity
associated with it seems almost
invariably to be accompanied
by a low tension pulse, but
there is a class of so called
epileptics in whom the seizures
come on about or after middle
life, and in many of whom
the disease is due to alcoholic excess, and in this class the characteristic pulse is one of high tension. Treatment directed to the lowering of the general blood pressure usually keeps the number of fits at a minimum and often serves to ward them off.

Attached are tracings which illustrate some of the conditions of the pulse met with in the forms of mental disease just referred to. With the exception of those belonging to epilepsy they cannot be regarded as of the same significance as those before described (e.g. in Stupor), but, just as in the case of any physical disease, the condition of the pulse must always be regarded as of importance in showing the effect of the mental disorder upon the general condition of the patient.

Such then are some of the conditions which illustrate the connection between the circulatory
system and abnormal mental processes. While in certain cases disorder of the circulatory system is a cause of insanity, much more often does mental disease produce circulatory disorder, but as the diseased brain depends to a great extent for its restoration to health upon a ready response to its demands upon the vascular system, so it becomes a matter of vital importance that the disturbances set up in the latter may not have passed beyond the bounds of control.

The importance of a careful study of the connection between the two cannot be overestimated, for however we treat our patients, by diet or drugs, baths or massage, rest or exercise, we must to a considerable extent seek to influence the brain cells through the circulatory system.
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