Observations

ON

CEREBRAL HAEMORRHAGE DUE TO
CAUSES OTHER THAN ARTERIOSCLEROSIS*

BY

JAMES COLLIER, M.D., F.R.C.P.

CONSULTING PHYSICIAN AND EMERITUS LECTURER ON NEUROLOGY,
ST. GEORGE'S HOSPITAL

The subject of cerebral haemorrhage due to causes other than arteriosclerosis, which I am introducing for your discussion, has caused very much interest and investigation, and our knowledge of its causation and successful treatment has been greatly increased during recent years, chiefly owing to Quincke's "lumbar puncture" and its almost universal use in the treatment of patients who present a picture of meningitis, of coma, of apoplexy or even of unexplained headache, and in the routine examination of the cerebro-spinal fluid in cases of disease of the nervous system. The result has been that at the moment a whole series of clinical states are well known to result from cerebral haemorrhage, some of which closely resemble meningitis, lethargic encephalitis, uraemia, diabetic coma, migraine and even simple headache with or without pyrexia, while others present as curious recurring and rapidly transient attacks of unconsciousness, hemiplegia, aphasia, or any combination of these. Some are dominated by the involvement of one or more cranial nerves, while the variety which is called haemorrhagic pachymeningitis seems to have a peculiar syndrome of its own which we are only just beginning to recognize.

Practically none of these features are mentioned in the descriptions of cerebral haemorrhage of twenty years ago and they are only now coming slowly into our modern textbooks of medicine. I take it that the arteriosclerosis which we are excluding from this discussion will comprise atherosclerosis, the mesial arterial degeneration of high blood pressure, syphilitic arteritis, and the calcareous arteritis of diabetes. It is remarkable that these common causes of cerebral haemorrhage hardly come into causal relation with the conditions we are to discuss to-day, with the exception of atherosclerosis. So that we have new pathological findings and ideas for the new clinical manifestations.

CAUSES OF CEREBRAL HAEMORRHAGE

The following list comprises the definitely known and the hypothetical causes of cerebral haemorrhage:

Injury during birth, or following trivial concussion—haemorrhagic pachymeningitis; oozing from blood vessels; increased permeability of walls; diapedesis; encephalitis; poliomyelitis; lethargic encephalitis; tuberculous meningitis; sinus thrombosis; venous bleeding; abnormal blood states; leukaemia; purpura; anthrax infection; insolation; neoplasms, from the rupture of poorly developed vessels in a soft growth; aneurysm—infective in ulcerative endocarditis, puerperal infection, gonorrhoea, etc., and occurring in coarctation of the aorta and also in polyarteritis acuta nodosa of Kussmaul and Dickson; the berry-like and often multiple aneurysms which have been termed congenital aneurysms. (Syphilitic aneurysms of the cerebral vessels seem not to give rise to haemorrhage, but berry-like aneurysms leading to haemorrhage are not uncommon in atherosclerosis.)

Haemorrhage, both meningeal and intracerebral, from the moulding of the head in parturition, seems to be an event of common occurrence. Many years ago Mraczek examined a very large number of infants stillborn or

dying within three months of birth, and found that some haemorrhage had occurred in one-fifth of all the cases. In its minor degrees this haemorrhage seems easily recovered from. When severe it may be the cause of stillbirth and of convulsions occurring soon after birth, but it is certainly never a cause of cerebral diplegia. The oozing of blood from vessels due to increased permeability of the walls which has been put forward by Osler and many others to account for slowly oncoming subarachnoid and subdural haemorrhage, is a pathology which will have little appeal to those of us who know well how slowly blood may escape from a leaking aneurysm, and how minute and difficult to find such aneurysms may be.

Encephalitis

Encephalitis is important in connexion with our subject. Poliomyelitis, though characteristically a microscopically haemorrhagic disease, does not seem often to cause major haemorrhage, either meningeal or cerebral. It is likely that the "plum pudding" brains with multiple large lacunar haemorrhages which were formerly claimed for this form of encephalitis would not pass the present-day histological tests. Lethargic encephalitis is of great interest in connexion with our subject, for from the early years of the nineteenth century onwards very many cases of subdural, subarachnoid, and cerebral haemorrhage from ruptured aneurysm have been recorded in which the clinical picture was hardly distinguishable from that of lethargic encephalitis. On the other hand many cases which have been proved histologically to be examples of this disease have been complicated by subarachnoid and cerebral haemorrhage. The only means of correct diagnosis is the histological test for lethargic encephalitis, or the discovery of another definite cause for the haemorrhage. I have myself made a mistake in the diagnosis of these conditions, for during the epidemic of 1919 a case came under my observation which from the influenza-like onset, the pyrexia, diplopia, rousable coma, and normal cerebro-spinal fluid seemed typical of lethargic encephalitis. At the necropsy I found an aneurysm of the posterior communicating artery which had become adherent at the edge of the left middle fossa and had caused a very large subdural haemorrhage filling the middle fossa as with a mould of currant jelly. The cerebro-spinal fluid was not even stained at the time of necropsy.

Neoplasms

Neoplasms of soft texture are important causes of cerebral haemorrhage, for such a growth may bring on a haemorrhage before the appearance of any local or general signs, and I have several times seen a fatal apoplexy in a young subject resulting from a haemorrhage into an otherwise symptomless glioma. We should bear in mind too that minor haemorrhages are of common occurrence in the substance of cerebral tumours and may produce a rapid increase in the severity of the symptoms.

Cerebral Aneurysm

Aneurysm of the cerebral arteries is at the present time attracting much attention as a very common cause of every variety of intracranial haemorrhage and as giving rise to the most varied clinical syndromes. Such aneurysms are held to be of common occurrence, and often give rise to no trouble during life, for at least one-fifth of the numerous specimens in our museums have been chance discoveries at necropsy; some of these have been very large aneurysms. They are never of syphilitic origin. The etiology of a minority is well known in the bacterial infections of the blood of infective endocarditis, of gonococcal, and of puerperal infections. In coarctation

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of the aorta, where the arterial tension above the constricted area in the aorta becomes extremely high when adult life is reached, the tunica media splits locally under the pressure with the formation of aneurysms which are often multiple. They are a feature of the curious malady first described by Kussmaul—"polyarteritis acuta nodosa"; and, further, they may occur in atherosclerosis.

But the cause of the majority of the cerebral aneurysms has not yet been determined with any certainty. Eppinger, from the absence of signs of any inflammatory process in the aneurysms and the negative etiology, termed them congenital aneurysms, implying that they were due to a local congenital defect in the arterial wall which at any time during life might bulge under the strain of the blood pressure with subsequent aneurysm formation. This view has been taken by Froin and by many others. Harvey found an aneurysm in a rabbit 14 days old; Turnbull recorded one in a child of 19 months; and they have been repeatedly found in children, though they do not as a rule give rise to symptoms until after puberty.

Murray Drennan found that these aneurysms often occurred at the branching of vessels and believed that a rupture of the muscular and elastic coats occurred at the acute angles formed by the union of cerebral vessels. He suggested that the eddy of the blood stream at such points might allow organisms to settle down in these regions especially, and so cause aneurysm. Wiley Forbus has recently shown that the muscular and elastic coats are normally absent at the angles of junction of all the smaller arteries; and, while he supports the theory of a natural weak spot at these sites, he necessarily invokes some other unknown factor which determines the appearance of an aneurysm only in some subjects and in a few places, although the "congenital fault" is common to all arteries and to all people.

I have called these aneurysms "berry" aneurysms because of their shining coats and rounded outlines; they hang like berries on the arterial stalks and are often multiple. I think that it is highly probable that many of them are really of infective origin from some low-grade blood infection which is otherwise symptomless. They are similar in location and appearance to the infective aneurysms, and like them are also found on the splenic, mesenteric, and other arteries of the body. There is yet another suggestion—namely, that the so-called congenital aneurysms may be caused by a local form of atheroma occurring in young subjects which often heals leaving linear scars upon the vessels. It is an interesting point that berry aneurysms have appeared in more than one member of the same family. Gowers records an example in two brothers, and Dr. Greenfield has met with two other instances.

SYMPTOMATOLOGY

Aneurysms seem to give rise to no symptoms at all, however large they may be, unless they clot up, calcify, become adherent to surrounding structures—generally some of the cranial nerves—or unless they burst. They may rupture frankly in any situation within or upon the brain, and then, whatever the position, they produce the syndrome of a severe rapidly fatal apoplexy with blood in the cerebro-spinal fluid. When the haemorrhage is less rapid and the aneurysm is buried in the brain substance, or has become adherent and bursts into it, the resulting picture is in no way distinguishable from that produced by cerebral haemorrhage from other causes. But these aneurysms have a tendency to rupture slightly and to leak slowly, after which they often heal, to leak again later on—often in another situation. They may leak into the subdural space and there form an organizing haematoma, liver-like in appearance and with a clinical picture,

sometimes closely resembling lethargic encephalitis, and at other times peculiar to this condition, as Dr. Martin will describe to us later. There is no blood staining of the cerebro-spinal fluid in this type.

They often leak into the subarachnoid space and then most commonly produce a syndrome precisely resembling meningitis, with headache, pyrexia, head retraction and stiff neck, and frequently with diplopia, vomiting, and convulsion: the distinction from meningitis is the presence of blood in the cerebro-spinal fluid and the relief produced by draining. There is one modification of this syndrome to which I wish especially to call your attention, and that is when no other signs of meningitis, except the headache alone, are present.

A lady who was touring in the country developed so severe a headache that she decided to return home, and drove her car from Liverpool to London without a break. I saw her immediately after arrival and could not determine the cause of her complaint; and though I had my needles with me and discussed the question of lumbar puncture with her husband, who was a doctor, I decided that there was no indication for it because she had no physical signs whatsoever except the headache. Some eight hours later and without the development of any further signs or symptoms she dropped dead when walking round her room. A lumbar puncture made after death showed copious blood under high pressure in the subarachnoid space.

The transient phenomena which may follow upon a not too rapid and not too copious haemorrhage upon or within the brain are very remarkable; some of them are difficult of explanation and all are likely to give difficulty in diagnosis, as they may occur without headache or signs of meningeal irritation. The more common of these transient signs are attacks of unconsciousness lasting from a few hours to many days, of headache resembling migraine, of hemiplegia, of aphasia, of convulsions local or general, of delirium with headache, of pyrexia with headache, of headache or of unconsciousness with albuminuria or with glycosuria of high concentration. I have myself seen all of these events, and doubtless there are many others. Here is a very good example:

A commercial traveller aged 30 suddenly fell unconscious at his work in a shop at Leeds and is said to have remained unconscious for sixteen days. A lumbar puncture revealed copious blood in the cerebro-spinal fluid. Thereafter he recovered rapidly and resumed work. A few months later he again fell unconscious for a short time, and on recovering was convulsed in the right hand and vomited. He showed marked slurring of speech and an extensor response on the right side. A lumbar puncture again revealed copious blood. He recovered in four days and returned to work. Two months later he was suddenly seized with mental confusion, weakness on the right side and aphasia. Blood was again found in the cerebro-spinal fluid and he once more made a rapid and complete recovery. Some time later he had sudden severe headache followed by delirium and convulsion; he recovered in a few days. Some weeks after this he came into the National Hospital under my care where I could find nothing abnormal about him except the bright yellow cerebro-spinal fluid.

Very many cases of this order have been reported, and notably one by the late Dr. Fearnside in which a series of severe but rapidly transient cerebral events including unconsciousness, convulsion, hemiplegia, and aphasia occurred one after the other. Each lasted but a day or two, and between these events the patient carried on with work. Eventually a third nerve paralysis from adherence of an aneurysm led to admission into hospital, where the frank rupture of an aneurysm into the cerebral hemisphere proved immediately fatal. Previously to the final haemorrhage there had been only slow leaking of blood into the subarachnoid space which must have caused the varied and isolated transient symptoms.

The lethargic picture so closely resembling that of lethargic encephalitis has been associated with slow cerebral haemorrhage ever since it was first reported in 1824 in connexion with a leaking aneurysm. I have seen it in subdural haemorrhage, in subarachnoid haemorrhage, and in slow intracerebral haemorrhage where there has been much ploughing up of the convolutions at the base of the brain. The distinction between these two conditions during life may be exceedingly difficult.

Delirium, convulsion, pyrexia, albuminuria, glycosuria, and the retinal haemorrhages (both subhyaloid and flame-shaped) give wide scope for discussion of their causal origin. Delirium and convulsion may be the result of the extravasation of blood on the surface of the brain: both may occur when there is no gross lesion of the brain. Pyrexia, albuminuria, and glycosuria suggest interference with that thin slice of the mid-brain which is known to be concerned with heat regulation, and with that region of the medulla in which the punctures of Claude Bernard produced albuminuria and glycosuria; but this cannot be the explanation, for I have seen all of these events in cases where these parts were entirely free even from surface haemorrhage. The flame-shaped haemorrhages and the papilloedema are obviously due to the increased intracranial pressure, and the subhyaloid haemorrhages must have a like origin in a very rapidly rising intracranial pressure. The latter cannot be due to the direct seepage of blood from the subarachnoid space into the retina, as has been maintained; for I have seen them when there has been no subarachnoid haemorrhage and again when the subarachnoid or the primary ventricular haemorrhage has never reached the anterior aspect of the base.

SITES OF RUPTURE OF ANEURYSM

My especial interest in cerebral aneurysm urges me to put before you a short list of the situations in which an aneurysm may burst or leak. I have seen examples of the following:

(1) Transdural Rupture: the case observed was one of aneurysm of the left posterior communicating artery in a young woman. It became adherent to the dura and ruptured into the outer wall of the cavernous sinus, producing great pain and loss of sensibility in the distribution of the first and second divisions of the fifth nerve and paralysis of the third, fourth, and sixth nerves. The pool of blood thus formed in the middle fossa of the skull ruptured later on into the subarachnoid space with immediately fatal results. (2) Subdural rupture. (3) Subarachnoid rupture. (4) Intracerebral rupture; (a) from a surface aneurysm which becomes adherent to the brain tissue; (b) from an aneurysm buried in the brain tissue. (5) Primary rupture into the ventricle. In this condition the wall of the aneurysm encroaches upon the wall of the ventricle and ruptures thereinto with little or no tearing of cerebral tissue. The interesting clinical aspect of this rupture when it is not too rapid exactly resembles that of the much more common subarachnoid haemorrhage. (6) Rupture of an internal carotid aneurysm into the cavernous sinus. The clinical picture is that of a unilateral pulsating exophthalmos.

In those aneurysms which rupture slowly and leak rather than burst, there is a great tendency for the rupture to heal locally and for another to occur later in another part of the sac—perhaps after this has become adherent to surrounding structure, especially the brain substance.

This is the common explanation of subarachnoid haemorrhages repeated at considerable intervals of time and followed not infrequently by a fatal rupture into the brain substance. Many of the aneurysms never rupture nor give rise to any symptoms, and many which leak heal permanently and become obsolete. Though we are discussing cerebral haemorrhage it is necessary for me to point out that when an aneurysm clots up in part or when its wall calcifies, then and then only does it give

rise to local pressure symptoms. And it does so most commonly in the region of the optic chiasma causing a syndrome indistinguishable from that of a pituitary tumour. Such a picture followed by signs of cerebral haemorrhage can be due to nothing else but aneurysm. Another common clinical antecedent to the leaking or rupture of an aneurysm of the posterior communicating artery is adherence of the aneurysm to the third or the sixth nerve, causing paralysis of these nerves.

The treatment of subarachnoid haemorrhage where the escape of blood into the thecal space is free is an interesting matter for discussion, since it has been held that repeated draining away of the effused blood by lumbar puncture increases the tendency to bleeding, though it undoubtedly relieves the symptoms greatly for the time being. My own practice is always to drain freely and repeatedly so long as the symptoms of increased intracranial pressure persist, and I have never had cause to regret this practice. The cases that you cannot drain generally die, and these are the cases where an extensive subarachnoid effusion of the convexity clots at its edges and so prevents the escape of the blood into the general subarachnoid reservoir while the collection constantly increases at its centre. Such cases usually end with extension of the blood sac into the cerebral substance—the meningo-cerebral haemorrhage of Froin. Other undrainable cases are those in which the haemorrhage is largely or altogether subdural. The cause of death in cases of cerebral haemorrhage is always the increase of intracranial pressure, and surely it is wise to keep this within bounds by draining whenever it is possible to do so.

ACUTE TONSILLITIS AND SOME OF ITS SEQUELS:

EPIDEMIOLOGICAL AND BACTERIOLOGICAL OBSERVATIONS*

BY

J. ALISON GLOVER, O.B.E., M.D., M.R.C.P.,
D.P.H.

AND

FRED. GRIFFITH, M.B., D.P.H.

MEDICAL OFFICERS OF THE MINISTRY OF HEALTH

In the following paper tonsillitis is considered as the local manifestation of infection with haemolytic streptococci. The subsequent course of this infection is dependent on two factors, the pathogenic qualities of the infecting strain and the state of immunity of the individual attacked. The size of the infecting dose is a contributory factor; it is difficult to estimate, but is probably proportional to the level of infection in the community and to conditions, such as overcrowding, which favour transmission.

We have described scarlatina as one of the sequels of this form of tonsillitis. This is a convenient way of differentiating the two clinical conditions, acute tonsillitis and scarlatina, which, apart from the presence of a rash and the greater risk of nephritis in the latter, appear to us to be almost identical, both epidemiologically and bacteriologically. The data which we put forward have been largely derived from inquiries into outbreaks at schools, and we are greatly indebted to the school medical officers who have assisted by supplying us with material and statistical information. We are unable to give their names owing to the confidential nature of these inquiries, some made in outbreaks in which the help of the Ministry of Health had been sought by the school authorities, and

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