Thesis
on
Cerebro Spinal Fever
by
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Cerebro-spinal Fever

Cerebro-spinal Fever has been recognised as a definite independent disease from the early years of the 19th Century. It has not affected the United Kingdom to any great extent; the principal outbreaks having occurred in the Continent of Europe, and in the United States of America. Widespread epidemics have occurred in these Countries, and Ireland has been the seat of extensive outbreak, in 1845-1846, 1866-1867; and as recently as 1900 a small outbreak has occurred in that country.

In England and Scotland cases observed have usually been isolated, and may be termed Epidemic.

Briefly summarising the history of the disease we find that the first distinctly described outbreak occurred at Geneva in 1806, and in 1814-1815 amongst observed at Paris and Brest. In 1814-1815, corresponding to the Continental outbreak, there was a widespread epidemic in the United States of America.

In 1837 the disease is again described as occurring in France, often limited to a single town, but at the same time widely scattered from appeared in Southern Italy, Sicily, &c.

In 1846, the disease broke out in Dublin and Belfast, and as in 1837 the United States plague was again the scene of extensive and very fatal epidemic.
Between 1854-1874 the disease again appeared in Europe, chiefly affecting the Northern part, Norway, Sweden, Denmark and North Germany. As in the case of previous epidemics the United States of America soon became affected, and cases again appeared in Dublin and other parts of Ireland in 1866-1867.

During the latter quarter of the 19th century the disease has never assumed very extensive or alarming proportion. Cases have frequently been seen in the United States of America, and as recently as 1900 in Dublin. In England and Scotland a few cases have from time to time appeared, but their advent has not been followed by an extensive epidemic. In 1877-1879 cases were reported at Dundee, in 1885-1886 at Dublin, and in 1890 in Hertford and Suffolk. 4 cases having been treated in the latter year at St. Bartholomew's Hospital, London.

In 1900 several cases having occurred in men of the Royal Navy, have made the disease a subject of study.

Etiology - The disease occurs in epidemic and in sporadic cases. As an epidemic it exhibits peculiarities which differ from other epidemic diseases - limited localities are usually attacked, whilst the areas over which these are distributed may be very extensive. The foci may be confined to
A village or even to a certain building, or a town or village, the intervening houses or districts being quite exempt from its attack.

The extension is usually quite irregular and rarely follows definite lines, though there have been exceptions to this rule. Some epidemics have lasted only a few weeks, attacking many or a few people, whilst in other instances they extended over months or even a year.

The epidemic may reach its maximum and then decline, but more frequently consists of limited outbreaks, which appear and disappear to be followed by others at a longer or shorter period.

The cases to be reported were entirely sporadic occurring in different ships and not spreading among other persons in these ships.

Children and young persons in the prime of life are most susceptible to attack. Wentworth in the Daniel 1 October 1898 says that most cases occur between the ages of 2 and 30 years, but persons beyond the latter limit may also be affected.

In the cases recorded the patients all were under 30 years of age. In the United Kingdom early manhood appears to be the most favourable period for an attack.
Both sexes are equally susceptible of infection, and negroes have suffered quite as severely as white men.

The disease has usually appeared in winters and springs, and epidemics have chiefly been confined to temperate and subtropical latitudes. However, in recent years I believe cases have also been recognized in India and China.

Epidemic cases occur at all seasons of the year, and of 85 outbreaks reported in the United States of America, 37 occurred in winter, 18 in winter and spring, and 23 in spring alone; the others occurring in the other seasons of the year.

Cold apparently contributes to an outbreak; many epidemics have arisen in cold seasons; although this is by no means an invariable rule, a smaller number having occurred in mild or even warm weather.

Dampness of the soil does not affect its occurrence, and the role played by bad hygienic surroundings is doubtful; both rich and poor having been frequently attacked.

Overcrowding, and bad ventilation, such as often formerly existed in barracks and workhouses, undoubtedly affected the spread of the disease, and on.
the Continent it was observed that officers, and others, who were better lodged than the men, used to escape.

Soldiers in garrisons have been very frequently attacked, both on the Continent and in America. In France out of 62 epidemics 43 were absolutely confined to soldiers, and in 6 the soldiers were chiefly affected; but occasional cases appeared among the civil population. In many instances it remained strictly confined to one set of barracks or one institution. In 1846 in the outbreak at Dublin, Bray, Belfast, the workhouses were attacked.

Certain families and communities appear to have a much greater susceptibility than others.

Fatigue has also been credited as a predisposing factor in this disease, it was observed that young soldiers were particularly prone to its influence; but the evidence on this point is not very definite. In the recorded cases it could not have been a factor, as the patients had not been subjected to any unusual strain.

The etiology of this disease may thus be described as very obscure. No satisfactory reasons having been determined for its attacks on certain countries or communities.
Contagion — That the disease is contagious from one individual to another seems to have been well established in Countries where extensive outbreaks have occurred, but the means by which the virus is conveyed from person to person is still very obscure. In garrisons which have been attacked, regiments have carried the disease to other places in their movement; and cases have broken out among troops stationed in barrack rooms, previously occupied by men who had suffered from the disease.

Inmates from home, other institution, as well as different members of a family, have repeatedly been attacked one after another; whilst persons in the immediate neighbourhood, who have not been in contact with the sick, have escaped. The disease may be transmitted from the patient to his attendant; an instance quoted by Reeser from the British Field Hospital, on an outbreak in a hospital at Colón, seems to add most conclusive evidence to the theory of contagion. A Sister and 3 Nurses in charge of patient suffering from cerebro-spinal fever were attacked by the disease themselves. They had not been outside the hospital building for a long time.
and as could not possibly have contracted the disease elsewhere. The nurses in wards not having cases of the disease in them were not attacked. Richter mentions a case of a woman who visited a house where 2 children had been sick with the disease and who developed meningitis on the 4th day afterward. She was visited by a man who 4 days afterward himself developed the disease. The disease was probably imported into Algeria and into Italy in 1870 by French troops. The medium by which the disease is transmitted is said to be articles of clothing which have been in contact with the sick. Instances have occurred in which clothing has been borrowed from infected persons by persons who had not been in contact with the sick themselves, but who developed the disease subsequently. Quite recently in West Africa the diplococcus pleiocellosus has been discovered in the sweat of patients, and this seems to throw some light on a means by which dissemination may occur.

Although the instances quoted point to the contagiousness of the disease, this is much less marked than in most of the other infectious diseases. The spreadin
from patient to patient in hospital wards, is rare. In 160 houses in Cologne where encephalitis from occurred, a second case developed in only 10 instances, and in 3 instances there were more than 3 cases. In fact, as a rule the disease has very frequently been treated in wards with other cases, and only in the rarest instance has it been conveyed to the body of this rarely in obscure. The exact channel by which the virus enters the body is also not ascertained. It has been found in the nasal mucous, pus from the ear, the eye, the sputum and urine. The most probable portal of entrance seems to be the nose. The diplococcus intracellularis may live for an unknown period outside the body, but is apparently easily destroyed by heat.

In the recorded cases, which occurred among boys and men, belonging to ships of the Royal Navy, there was no instance of the disease spreading to other persons.

In 2 instances, 2 cases came from the same ship, but were separated by long intervals of time. Owing to the close proximity in which persons live on board ship, one would expect other persons to contract the disease; and other infectious diseases often spread very rapidly.
General Sketch of the Disease

Cerebro-spinal fever is an acute specific disease which has generally occurred in epidemic form and has caused a high rate of mortality of those attacked. It also occurs sporadically, and in this form has usually been met with in England and Scotland. It may be classified with other acute specific fevers, having a definite course, with periods of incubation, invasion, advance, and termination.

A definite microorganism has frequently been discovered in the lesions found after death, and pure cultures of this microorganism have reproduced the disease when injected into the spinal canal of guinea pigs in a few instances. Moreover, the microorganism has also been found in the meninges and subarachnoid space of the animal when dead. (Wentworth)

Its method of attacking human beings is unknown, but older remarks that no fever attacks so few individuals of a community, whereas any known fever kills so large a proportion of those attacked.

In his experience 76 out of 111 cases died, giving a mortality of 68%, though estimates the mortality as varying from 20 to 70%.
The disease nearly always commences suddenly. A person in good health and in the prime of life, after a period varying from a few hours to a few days, is seized with severe headache, often excreating in severity, accompanied by vertigo and vomiting. The pain almost immediately in a few hours extends to the back of the neck and to the extremities; this sudden onset, progression distinguishing the disease from other forms of meningitis. Some degree of mental disturbance is generally noticed early in the attack, varying from apathy to complete unconsciousness.

Delirium, which is sometimes violent, may supervene, or come rapidly follow.

In adults, there are often preliminary rigors; in children, chills are more common at the onset.

Sometimes there are some prodromal symptoms such as chills, headache, vague pain in the back and limbs, vertigo or vomiting - a point observed in 27 of the recorded cases was the presence of severe abdominal pain, headaches with vomiting and diarrhoea before definite symptoms appeared.

The headache is usually frontal at first, but may be occipital. Sometimes
it is localized, but more often it is felt all over the head.

In all the cases observed from the commencement it was a marked symptom. As a rule it was very acute, patients boring their heads into the pillows, in nearly all cases it persisted longer than any other symptom. Vomiting is most intractable, appearing early in the disease, and being uninfluenced by therapeutic measures. The vomiting Matter was usually bloody in amount and consisted of mucus, often bile-stained.

The face may be pale or flushed, the features bearing an expression of extreme anxiety or being drawn with pain.

The pain along the spinal column, and at the back of the neck, which closely follows the headache, is often very severe, chiefly affecting the cervical and lumbar region, and often radiating to the limb and abdomen, accompanied by stiffness of the Muscles of the Neck region.

The stiffness of the Cervical Muscles is a marked feature of the disease, the muscles are firmly contracted, all efforts made to flex the head being strongly resisted and causing pain. The head is often retracted, & the retraction
May be so marked in the spinal muscles, as to produce spasticity or spasm.

Movement of the limbs cause pain, the patient groans or cries out when these are attempted.

The rigidity of the neck muscles varies in severity, and sometimes is not observed at the first onset of the disease, often persisting after the painful condition has subsided. This feature is particularly marked in Case VI.

Pain in the limbs are not so marked as pain in the spinal muscles. Sometimes the limbs are rigid and there may be twitchings, contraction or cramps.

Nervous Sega. In 1882, a Russian, Nervis, noted a condition of contraction of the muscles of the leg in cases of spinal meningitis, and his observations have been repeatedly confirmed by many other observers.

This condition is as follows—when the patient is propped up in bed there is a certain amount of flexion of the knees, and on attempting to extend the leg there is a contraction of the flexor muscles, presenting this movement being fully carried out. If the patient be lying on his back and the thighs flexed on the abdomen, the legs or the thighs, attempt beyond
the leg are strongly resisted.

This sign occurs in other forms of meningitis, and so in itself is not a conclusive proof that the disease is of specific origin, but it only occurs in cases where meningitis is present. Kernig himself found it in 15 cases, in 8 pelvis the diagnosis was confirmed after death, and Netter found it in 45 out 450 cases.

The latter observor explains the production of the contraction as follows: "In consequence of the inflammation of the meninges, the roots of the nerves become irritable, and flexion of the thigh upon the pelvis, when the patient is in the sitting posture, elongates and consequently stretches the lumbar and sacral root, thus increasing their irritability. The attempt to extend the knee is insufficient to provoke reflex contraction, but in the back with the thigh extended upon the pelvis, but does so when he assumes a sitting posture."

This sign is noted in several of the recorded cases.

Tremors has occasionally be observed, also nystagmus and facial paralysis.

The patient, whether conscious or unconscious, are restless, often utter short cries.

Cutaneous hyperesthesia commonly appears
early in the disease. It may affect the
entire trunk and limbs, or
be limited to the trunk. It is not
always present in mild cases, but
in severe cases may be so marked that
the patient cries out when touched or
moved.

Mental Conditions. Delirium occurs early
in many cases, and may be muttering in
character or violent. It is not constant or
persistent often disappearing suddenly;
in many cases the patient answers
questions rationally.

The mental reflex may be dulled or
stupor may supervene, and shouting or
gentle shaking may be necessary in
order to obtain a reply.

Coma may appear very early in the
attack, especially in severe cases. More or
so in those described as fulminant; it
may persist till the advent of death.

Sometimes it appears gradually, the
patient who may have been delirious, gradually
lapseing into a comatose condition.

Coma may pass off, and this is always
a hopeful sign in the progress of the
case. Insomnia is often a troublesome
complication, but is not a constant
condition.
Affections of the Organs of Special Sense.

These affections are sometimes a marked feature in this disease, the meningocoeal inflammation spreading along the optic and auditory nerves and involving the organs which they are in connection with.

The Eye. Numerous lesions of this organ have been observed, but none are constant, and in the cases described they have been insignificant. The pupils may be normal, dilated or contracted. The first condition is perhaps commonest at the commencement of an attack. Sometimes they are unequal in size and react sluggishly to light. Photophobia is often present.

On external examination, conjunctivitis is nearly a constant feature in this disease. Pilocarpia may be noticed. Pilocarpia and strabismus have also been recorded. General cerebral and spinal symptoms are much more common than local ones.

Among the conditions which have been observed by others may be mentioned, tria, keratitis, purulent inflammation of the choroid, leading to detachment of the retina. Optic neuritis is not uncommon, atrophy...
May follow, producing permanent blindness.

The other condition are not necessarily permanent, may be recovered from.

The Ear. The auditory apparatus is more frequently affected than the visual. Fissures and deafness are often noted early from extension of the inflammation along the walls of the auditory nerve, as in Case V were marked. Suppurative otitis may follow with destruction of the entire membrance, producing permanent loss of hearing.

Anosmia has been noted by some observers.

The Temperature. Unlike many of the acute specific fevers, the temperature of this disease is most irregular and indefinite. Fever is sometimes absent or very slight at the commencement of an attack, but in the first few days suddenly rises to 102°, 103° or 104°. However it is usual for an attack to be ushered in by a sudden rise of temperature. There is no definite and constant ratio between the amount of fever and the other symptoms of the disease, and this is a marked feature in this disorder.
The temperature may remain elevated for several days, then fall nearly to normal, or throughout an attack may be extremely irregular. In cases lasting over a week, remittent and intermittent types are not uncommon. Sometimes, the fever ends in leucin, and this is always a favourable factor in prognosis. Recurrence of temperature are occasionally recorded.

The complete absence of uniformity in the temperature chart of the disease is a notable feature.

Fever - The course may be absent or lessened. Strümpell found this to be so in 5 out of 32 cases.

Abdominal symptoms - Abdominal pain is noted in several of the recorded cases. This is most indefinite, occurring on the first day or two of an attack, sometimes preceding other symptoms. It has been felt in the epigastric region, also in the right iliac fossa, but apparently does not remain long marked in any particular region. Desquamation may be present. Sometimes the abdominal muscles are rigid.

Nasal catarrh occurs in some cases. In protracted cases, hemiplegia or hemiplegia have occurred.
Skin Rashes are often a marked feature in this disease, and are of the greatest assistance in diagnosis.

Several varieties have been described, viz. erythematous, vesicular, bubblous—rose spots like typhoid, herpes zosterine. Herpes, petechiae, erythematous rashes were also observed in the recorded case.

Herpes is very common. It appears on the face, lips, and on some instance has been observed on the face paint.

The period of occurrence is usually within the first week, usually on the 3rd or 4th day of the disease, and it commences to disappear on the 6th or 8th day — some observers have thought that the occurrence of herpes is a favourable sign in prognosis, but the general opinion seems to be that it has no special significance.

In some epidemics it has been rare, but if the different eruptions of the skin it is perhaps the most constant.

Petechial and haemorrhagic Eruptions

In some epidemics eruptions of this description have been very frequently observed, and have given popular names to the disease. In the Dublin Epidemic of 1866-67, the disease was known as
Malignant Puerperal Fever, in America it has been commonly known as Spotted Fever. This variety appears in cases.

The eruption may occur in small dark red spots, but more often in large, large areas, has been compared to mulberries.

The spots or patches appear early in the disease, when spread over large areas of skin indicate a severe attack.

The color is usually dark red or purple and occurs on the trunk, limbs, they do not disappear on digital pressure.

Rose spots - like typhoid fever have been seen in some cases.

In Case 1. There was a diffuse loosening of the skin in the first day.

The illness which looked like measles.

Arthritic Symptoms - Acute inflammatory joint pain has frequently been observed in some epidemics. The knees, shoulders, elbows, wrists have all been affected. The joint become red and swollen, effusion takes place into the Synovial Membrane. This may be absorbed or become purulent. The tendency of these affections is towards resumption after perfect recovery, but in some instances stiff joint have resulted.
Periarticular abscesses have also been observed.

**Digestive System.**

Rashes protruding are two of the earliest and prominent symptoms of the disease. The latter may be most intractable, & in the recorded case, consisted of mucus which was sometimes bilestained.

The tongue present nothing characteristic. It may be quite clean, but is usually covered with a little whitish put. The may become yellowish.

At the commencement of an attack there is anorexia, but the appetite is soon recovered & during convalescence may be voracious. Thirst is not marked.

Constipation is an important & nearly constant symptom. It is generally marked early in an attack & may persist throughout it. Ores need regular, constant purgatives, or enemata for its relief. In one case where constant slight relapses occurred it seemed to be a predisposing factor.

**Circulatory System.**

The heart is not affected in any way differently from acute febrile disorders - Pericarditis may occur. Pulse. The pulse rate is not usually
increased at the commencement of an attack may be slower than normal. After a few days it becomes accelerated and may be weak and irregular. A notable feature is its variation in frequency at different periods of the day.

Respiratory Dyspnea

The rate of respiration is not increased in this disease, unless pneumonia arises as a complication.

Croupous pneumonia has occurred frequently in some of the epidemics of cerebrospinal fever in America and Germany. Epidemic of the two diseases may occur coincidently. Some observers, prominently among whom is Réher, think that meningitis can be produced by the pneumococcus as well as the diplococcus intracellularis; others emphatically deny that the pneumococcus has any part in its production. Meningitis does arise in cases of pneumonia, but most observers appear to regard the presence of pneumococci in cases of cerebrospinal meningitis as merely a chance, and not as an essential fact in the causation of the disease.
In some ways the two diseases have point of similarity both being most frequent at the same season of the year, having a sudden onset with the early appearance of fever. But on the contrary Chorea pneumonia has a typical course severe whilst cerebros spinal fever has none. Broncho pneumonia & pleurisy, sometimes, appear as complications, & pulmonary congestion has frequently been reported in cases of this disease.

Haemopoietic System:

Lymphocytes is present in all cases - Councilman, Mallory & Wright in their research found that in 33 cases the number of lymphocytes were markedly increased, & that in the cases that recovered there was a gradual diminution of the number.

Spleen is not usually enlarged, but has been found to be so in a few cases.

Urinary System:

The urine is generally normal in amount. Ketone found albumen present in 1/3 the cases, but not in large quantities. Retention of urine is said to occasionally occur in adults.
Course and Duration of the Disease.

The course pursued by this disease, the duration of an attack, and the severity of individual attacks vary greatly, but it may last from a few hours to 30 weeks. There is usually a period of remission lasting from a few hours to 3 days. The symptoms during this stage may be very acute. The headache, spinal pain, fever, and vomiting may be intense. In some instances, the temperature may be very much elevated for the first day or two, but this is exceptional. A point noted in some of the cases was vague abdominal pain with elevation of temperature, but no marked cerebrospinal symptoms on the first day.

After this stage, there is often a short period of remission, with some amelioration of the symptoms; but this is usually of short duration. The acute nature of the complaint rapidly returns.

The disease may terminate fatally in a few hours or a few days, or be prolonged over weeks, death taking place from exhaustion. Recovery is usually slow, the convalescence being very gradual, headache may persist for months.
In a small number cases, recovery commences after a few days.

Recovery is often complete, although sequels frequently persist. The commonest of these are headache, deafness, neurological and amnesia. Hydrocephalus is a sequela sometimes observed in children.

Relapses and second attacks are not common but may occur.

Types: Several distinct forms are described, the generally recognised ones are:

1. **Phenomenon**: The onset very sudden. The headache, vomiting, constipation, or stupor rapidly appear, and death occurs in 12 to 36 hours.

2. **Acute Cases**: Lasting from 2 days to 2 weeks. Resemble former variety, but are not so severe, and several symptoms may be absent. Resemblance to affection may occur. Symptoms may subside, then reappear as severely as before. Four cases fatal.

3. **Intermittent Cases**: In which for several days the temperature may become normal, and then a fresh attack occurs.

4. **Chronic Cases**: Usually acute at first, and persisting with varying severity for months.
5. **Abortive Cases**—in which the disease in 4-5 days disappears. This type has been observed when an epidemic is declining.

6. **Wid Cases**—These begin suddenly like acute cases, but the symptoms now become severe. Recovery does not take place without complications.

**Pathology and Morbid Anatomy.**

In 1887 Weichselbaum discovered a diplopleces in the Escalation surrounding the brain and spinal cord which he named the Diplopleces Intracellulares Meningitidis or Meningococcus. This has since been nearly generally regarded as the specific cause of the disease. This organism is found in the polymorphonuclears of the meningeal Escalation, and a few may be found free in the fluid itself. Retin believes that the meningococcus may cause meningitis. It has also been found, though rarely, in the blood, nasal mucosa, pus from joints, and consolidated patches in the lungs. It grows best in stiffer blood serum, or stained by anthracine dyes. When cultivated it appears...
to have feeble vitality, but appears to resist drying. It is probably capable of aerial nutrition. In a few minutes, according to Bentworth, the disease has been produced in goats by the injection of culture of the organism into the spinal canal. The organism has been recovered from the exudation.

The means by which it gains access to the human body is unknown, but in some cases the nasal mucous membrane may have been the channel of infection.

The lesions produced by it, in brain are almost entirely confined to the pia-arachnoid membrane. An acute purulent inflammation is produced, effusion takes place into this membrane very early in the disease, following a preliminary hypertemia or Clouding. The early effusion is clear, cloudy or blood-stained, or it may be gelatinous. Pus formation rapidly follows, and after death the exudation may be liquid or semifluid. In the brain it may be found spread over both hemispheres, or confined to the under surface of the cerebrum and cerebellum.
In the spinal cord the lower dorsal and lumbar region are most constantly affected by the inflammatory process, but sometimes this is found along its entire length.

The effusion may be found spread out like a sheet over the surface of the brain, or in streaks and patches along the lines of the vessels, and in the fissures and sulci.

The inflammation has a marked tendency to spread along the nerves, and in this way the optic, auditory, and 5th nerves are sometimes affected.

It may spread to the subarachnoid of the brain and spinal cord, producing infiltration taking place along the vessels, and elsewhere, causing congestion, diffuse or circumscribed softening with small haemorrhages.

Effusion may occur into the ventricles of the brain, but this is seldom purulent.

At post mortem lividity is marked, the blood fluid - ecchymoses - seen in the splanchnic organs.

Congestion and oedema of the lungs may be found - and patches of pneumonia the liver and spleen may be engorged.
with blood.

Rheumatism and pericarditis are sometimes found.
Suppuration of the Middle ear, eyeball, and effusion into the joints may be found in some cases.

**Diagnosis** – During epidemics, this may be easy, but when sporadic cases occur in countries where the disease is little known, the way present considerable difficulty. The disease has to be differentiated from other forms of meningitis. If possible it is specific nature demonstrated by microscopic examination of the cerebrospinal fluid and

It has also to be distinguished from certain other acute diseases.

In the *Nomenclature of Diseases* of the Royal College of Physicians of London, 4 special forms of meningitis are recognised viz: *Purulent, Tuberculous, Syphilitic, and Cerebro-
spinal (Epidemic).*

Having determined that meningitis is present it is necessary to differentiate the special form from the other varieties. The onset of Cerebro-spinal Meningitis is abrupt, often arising without any warning. The other forms are usually
incubation or slow at first, and local tubercula or septic disease may be present, or a history of syphilitic infection may be obtained, which might direct the attention to them as a cause.

Temperature - Although by no means always the case, the temperature of Cerebro-spinal fever may be high from the commencement; pain attack. Sometimes there is no fever for a day or two, but in all cases, where fever is present, there is a complete absence of regularity in type.

In tuberculous meningitis the fever is usually not high at first.

In septic meningitis the fever rapidly assumes a hectic type.

The headache, pain and stiffness of the neck, the rigidity of the vertebral column, and hyposthesia are usually present, happens at an earlier period than in any other form of meningitis.

The skin rashes which also appear early in the disease are most significant point in septic meningitis. Petechia, also appears at an early stage of this disease.

Lumbar puncture - Penetrating the spinal canal with an exploring
Needle, and withdrawing some of the meningeal exudation is the most valuable means of diagnosis that has been advocated.

Quincke, who introduced the method recommended that the puncture should be made between the 3rd and 4th lumbar vertebrae just outside the middle line. The fluid thus withdrawn can be subjected to bacteriological culture and staining.

Counselman, McIlroy Wight of Boston, USA found diploceci in 38 out of 55 cases examined. There are apparently no ill effects after puncture.

Cerebrospinal fever has to be distinguished from other acute diseases by enteric fever, typhus fever, influenza and pneumonia.

In enteric fever the headache is less marked, the onset is insidious. Post-enteric intestinal symptoms are more marked and the spleen is generally enlarged.

Typhus fever from the Neubury rash may be confused with the parapunk of cerebrospinal fever. Clinically, apart from the distinctive meningeal symptom there is irritability in the latter rather than apathy, and the intense headache Kernig's sign help to distinguish the disease.
In cerebro-spinal fever the eruption appears almost immediately, whilst in typhus it appears on the 3rd, 4th, or 5th days. Delirium is often early in cerebro-spinal fever, but usually till the end of the first week in typhus.

Influenza is perhaps one of the most difficult of the acute diseases to distinguish from cerebro-spinal fever until distinctive features develop. In both there is a sudden onset with severe headache and pain in the head and back with general pain all over the body. Then is sometimes delirium and vomiting. The two diseases may also be present at the same season of the year. Cerebral symptoms are pronounced in influenza and often quite absent in cerebro-spinal fever. The appearance of a purpuric rash early decides the diagnosis from cerebro-spinal fever, but the presence of pleocytosis in the spinal fluid is the surest means of diagnosis if marked cerebro-spinal symptoms do not appear early.

In pneumonia the physical signs in the lungs clear up the diagnosis, but meningitis may follow an attack, and pneumonia is a fairly common complication.
in cerebro-spinal fever. It is believed that the
meningococcus may be capable of
producing cerebro-spinal fever as well as the
meningooccus, but his views are not sustained
by American observers.

Prognosis: This is always serious and in
many epidemics the mortality has been
very high. It is impossible to say how
long the disease will last or what its
termination will be until the lapse of
a considerable interval of time during
which the patient is free from symptoms.
This interval cannot be definitely
stated, but 2 weeks has been suggested
as a fairly safe estimate. Convalescence
and cure early in the disease are highly
desirable. In many cases, however, the disease is
very protracted, even after the patient
is apparently recovered. Relapses may recur
and death may occur. Complications by pneumonia
may supervene and cause death.

It is not possible to say whether acute
cases will become intermittent aseptic
and in all cases the prognosis is hopeless.

Treatment. Upto the present time the treatment of this disease has been most unsatisfactory, and is chiefly symptomatic.

Owing to the indefinite knowledge of the predisposing causes and mode of infection, no prophylactic measures can be formulated. It is always safer to isolate cases, to take the same precautions observed in other acute specific disease for preventing the spread of the disease.

Everything that has been in contact with a patient should be destroyed or disinfected, & the excreta should be mixed with a disinfectant before being thrown away as a matter of ordinary precaution.

There is no known remedy which check the disease or shortens its course. In old days depilatory measures were always pursued, but have been entirely abandoned in modern times.

In the symptomatic treatment of the disease the most valuable drug we possess is opium. The best method of administration is by hypodermic injection, morphine 8/4 of the sulphate administered three daily, or even 8 times in severe cases. Relieves the pain and reduces the restlessness.
Brownide of arsenic, with or without Chloral Hydrate, in large doses, also prove beneficial.

The baths may be applied to the head and along the spine, and at the commencement of an attack the bowels should be freely cleared out by a purgant aperient, Calomel and a saline cathartic being as good as any. Salicylic acid and Salicylate of soda are prescribed by some observers, but their value is doubtful. Warm baths have also been recommended, but no form of treatment appears to affect the course of the disease more than relieve special symptoms.

The diet should be liquid, consisting chiefly of milk and beef tea in the acute stage, but as soon as the appetite returns, other easily digested forms of nourishment may be added.

Contusion must be met by aperient and emetics.

Irruption puncture has been repeatedly tried for curative purposes, but although of great service as a means of diagnosis, has not proved of any marked or lasting value.

Gumma therapeutics have, up to the present time, not been adapted in this disease.
Summary of Cases:

1. Male aged 15 years—Bled at 7 am on April 2nd, 1902. Complained of severe headache. T 101.8, Pulse 80 per minute. At 8.45 am when seen again, was found to be more or less comatose, and could not be roused—resistant to all attempts.

April 5th. T 103.8. Pulse short and strong. Hoarse. At 11 am patient was cyanosed at 3 pm. Treatment: Bromide, strychnine, and hypodermic injection. On the last day illness, strychnine was injected for 10 minutes every 2nd hour. On the 12th day, strychnineagain hypodermically, when pulse was failing. Ice bags were applied to head.

April 6th. Post Mortem Examination:

Pericent lymph was found on upper surface of cerebrum, and also at the base of brain.
along the line of the vessels, which were engorged. No excess of fluid in subarachnoid space, and in masticating, a clear glass preparation of the and staining, diphreosi was found.

D-shaped, left, old fibrous adhesion of pleura, red hepatization at base.
Right - small patch yellow hepatization in central lobe. No sign of tuberculosis.
Heart - firmly contracted. But normal
Intestine - Normal.
No abscess of intestinal cæs.

Case II. Male aged 17 years - belongs to a Fleming ship.
April 7th, 1900 - At 8:30 a.m. complained of headache. Croupy right ear and throat. On trunk there was an indefinite resinous rash - T99° - a few hours after bed, this rose to 110°. Pulse 120, face flushed, severe headache. Vomiting, stiffness of the neck, difficulty in sitting up without bending knees.
At 7:30 p.m. had a fit. When seen was unconscious, pupils widely dilated, throwing himself about, grinding teeth. Marked photophobia & persistent vomiting at 103°.
April 8th. T102. Pulse 96. Slept till 4 a.m., then became noisy & restless. Pupil less dilated, lie curled up in bed, but throws arms about. Cries out occasionally. Does not appear to understand when spoken to.
April 9th 1902. Noisy delirium during the night—increasing delirium—passed into bed. To conceín. Complaining headache at back of head. Arms feels strongly placed.

April 10th 1902. Irregular. Considerable hyperesthesia—strength failing during the day. Cyanosed—died at 9.20pm.

Treatment—Morphia. Ice bag. Head—buccal cavity.

Post Mortem Examination—3 days after death.

Brain: well marked dependent parts deeply congested. On opening skull, some matter found to be deeply congested. Discoloured lymph between cerebrum—marked between cerebrum—tissue. Undersurface of brain covered with thick lymph, extending down to the spinal canal.

Spinal Canal—Meninges deeply congested along the whole length—pus in subarachnoid space on cutting and across, about 1 dram. of pus exuded from the cut surface.

Some blood stained serum in right pleural cavity—intestinal organs otherwise healthy.

Some dilated vessels found on staining. Meningeal irritation.

Case III. Male, 17 years, belonging to same ship.

October 3rd 1900 On the evening of this day complained of headache, pain in his limbs. T103.2
Torque colitis - feel quite well up to previous evening, at 11 pm temperature had risen to 104° - slight pain in abdomen complained of referred to left hypochondrium - abdomen tympanitic - Borello open - stool loose.

October 4th 1999: Persistent vomiting & retching - vomited 3 times. Emesis of dark bile stained mucus & the quantity was nearly 3 lbs. dark colored at first but later was light brown. Anus was very loose - abdomen tympanitic - No dulness on percussion - tenderness in right iliac & left hypochondriac region - Bowel headache - face flushed - Stomach passed into the bed - Bell trained

October 5th 1999: Temp: 101.4. Slept badly, well seen bright - Abdomen not as tender - only vomited once during the night - Torque known & day - Bowel open - slight Epistaxis - Patient seated & prone - lie on belly.

4 p.m. : a great change noticed - T 99. Restless - Dr. Perry's demineralised, though when probed up answers question - lies on left side - head retracted - When placed on back there is Epistaxis - Reck cannot be placed - Kernig's sign present.

No apparent presence of patellar reflex - ankle flexion, elicited on left ankle - is a lesser degree - right pupil sluggish and contracted - Conspicuous slightly compressed - some chemosis - right upper eyelid - No discharge - Right cheek tender - Eyelid puffy - Wince drawn off by catheter.

103 - dark colored - Nothing noted by ophthalmoscope
Case IV
J.T. 26. belonged to merchant navy. Had been sick at his own house for several days. When seen on the deck was found to be semicoma. Breathing rapidly. Pulse 76. There was general muscular rigidity. The head was retracted. Pupils dilated off rent to light. Coni out occasionally.

No post mortem examination allowed.

Case V
Male aged 17. Belongs to a battleship.
July 5th. First seen on this date having been under treatment for 3 days on board with headache, described as splitting & shivering. 101.2.
When admitted to hospital complained of severe pain in his back. Characteristic throat. There was a history of delirium & once epistaxis on the preceding night. A Mutton looking rash was observed on lower part of the abdomen. Severe pain in head. Shock. Epistaxis. Kernig sign marked - herpes on lips.
20th July. Cerebral breathing observed.
21st July. Symptoms less marked. Feel better. No delirium.
22nd July. Feel well. Can lift head. Herpes disappear.
24th July. Kernig sign still less marked.
19th August. Kernig sign still present. Senile attack commenced. There has been progressive wasting of muscle. No tenderness along spine.
28th Nov. Again vomiting with headache.
23rd Nov. General health considerably improved. Was discharged to his own home.
<table>
<thead>
<tr>
<th>Name</th>
<th>J.M.</th>
<th>Age</th>
<th>Disease</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
</tr>
</tbody>
</table>

**Graph**

- **Fahrenheit**
  - 106°
  - 105°
  - 104°
  - 103°
  - 102°
  - 101°
  - 100°
  - 99°
  - 98°

- **Celsius**
  - 40°
  - 39°
  - 38°
  - 37°

**Observations** taken at 9 A.M. and 9 P.M.

**Pulse**
- M. M.
- E. M.

**Respirations**
- M. E.
Case VI

Male, aged 16 years, belonging to a training ship. October 18th 1900. Complained of headache and pain in back. T100.6. Not felt well for 3 days. Pain commenced on day previous to being seen. Head retracted. Pain at back of the head, neck, and along the spine.

19th October. T102. Legs flexed cannot be straightened. Marked tenderness along the spinal column.

20th October. Pain in the lumbar region. Occurred occasionally.

24th October. Retraction of head, neck, and back. There is tenderness all along the spine down to the coccyx. No delirium. To worsen, better.

10th November. General aching in limbs, symptoms but head, neck are still retracted. Pain improvement slowly continued. Was able to leave the hospital on December 18th.

Case VII

Male, aged 15 years.

20th June 1900. In morning complained of slight sore throat and pain in right ear. Slight cough. T103. Had a spell of feverishness during the day and screaming attack and attempted to get out of bed. An ice bag was applied to head and for some hours pain at right.


24th June. No improvement.


26th. Symptoms much worse. Died at midnight. No autonomic abnormal.

Case VIII. Male aged 17 years.

April 20th, 1908. On previous afternoon complained of severe headache, and pain in right side chest above the nipple. No cough. No abnormal physical signs in the chest.

On this date morning temperature was 101.6. Patient restless, irritable. Complained of headache and pain in the right side chest above the nipple. No cough. No abnormal physical signs in the chest.


June 23rd. Retching. restless at night. Pain in face
June 24th - no stiffness present - Body cool.
June 25th - slight pain in neck - still cold out at times - no albumen in urine.
June 27th - at 8:30am had a sign lasting 15 minutes. Temp: 104. Return of headache & pain in neck.
Nausea - Chest sounds normal.
June 28th - Cured with pain in head & herpes palmaris - slight pain on pressing abdomen.
From this date symptoms slowly disappeared. She was able to go away for a holiday on July 21st.

Remarks on Cases.

Of the 8 recorded cases 5 terminated fatally, and 3 recovered. All may be described as acute at onset, and case V, which recovered, became chronic - the ages varied between 15-26 years, but all the cases except one were under 20 years.

The patients were nearly all boys belonging to training ships, and in no instance did the disease spread to another person. In no instance more than one case occurred in the same ship, but a considerable period of time elapsed between them precluding any possibility of direct infection.

In 7 cases the onset was sudden, and in the remaining case, which occurred at his home,
the mode of onset was unknown.

In 2 cases there was a history of not feeling well for 3 days before the onset of acute symptoms.

In 5 cases Kernig's sign was distinctly present and the patient generally lay curled up on one side.

In instance diarrhoea, abdominal pain & persistent vomiting were present for a day before marked optical symptoms were observed.

Headache was universally one of the earliest symptoms, being in most instances most acute - in some of the cases the patient bore their heads into the fellows. The exact site of the pain was difficult to ascertain, and generally appeared to be diffused over the whole cranium.

Vomiting was nearly always present early in the attack and was most intractable. The vomiting matter consisted of mucous, often bile-stained -

Sweat in the neck of the neck was also a constant symptom, accompanied in most instances by stiffness or rigidity of the muscles, causing retraction of the head.

Restlessness and irritability were nearly always observed, and in 1 fatal case coma set in from the commencement of the attack. In another instance encephalitis occurred in the first day of illness.
and in several others there were periods of universal nervousness. Case made repeated attempts to get out of bed, and that if the patient uttered short cries or groans, screaming being frequent in 1 instance the same patient exhibited hyperesthesia. Anemia was marked, and pain all along the spine was complained of in several instances.

Eye symptoms were not marked. In some cases the pupils were equal, wide and reacted to light. As the disease progressed, toward a fatal issue the tendency was towards dilatation, and in the case that had meningitis they were widely dilated at the time.

Contractile and sluggish reaction to light were noted in 1 case.

Slight conjunctival congestion was noted in several instances, and photophobia was sometime present. Weakness was noted early in 1 case, and another had pain in the right ear.

Skin eruptions were not universally present. Cases had purpuric eruptions, which was described as mulberry. Subsequent herpes was twice observed on eruptions resembling the skin was.
As seen in Case 11

In Case 1, pneumonia in an early stage was found at post-mortem examination, but lung complications were not as commonly present as in some of the described epidemics.

In the cases that survived more than a few days, marked wasting of the muscles was soon observed.

Constipation was nearly always present, often requiring enemas for its relief.

In the treatment, morphine gave considerable relief to the pain, but none of the other means tried seemed to be of any effect.
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