Thesis.

for Degree of M.D. (Edin.)
on

"Acute Ascending Paralysis"

by

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April 1897
In the course of this Thesis, many references will be made to a series of papers on "Peripheral neuritis" by the late Prof. James Ross of Manchester, which appeared in the "Manchester Medical Chronicle," Vol. XXIX, 1889-90; especially to a table in which about 90 cases of "Landry Paralysis" have been collected together. Whenever a special case from this table is quoted, the original author's name is given along with it.
Dudd House, MELTHAM, 
Huddersfield.

May 5th, 1897

Correction in Thesis on

"Acute Ascending Paralysis."

by J. H. Green.

"We may look upon "Dehais" as the exact "Counterpart"

of Landry's Paralyias—the

one causing violent paroxysmal

contractions of the muscle,

the other a rapidly

extending paralysis." (Page...)

Should read:

"We may look upon"
Acute Ascending Paralysis is a condition of great interest, not only because of its comparative rarity, but also on account of the very diverse opinions which have been held as to its causation.

The first published cases of the disease (ten in number) were contributed by Landry in 1869. Hence it often goes by the name of "Landry's Paralysis." Since then other examples of the disease have been recognized from time to time; and in 1889 the late Prof. JamesRoss of Manchester was able to collect and tabulate about 90 cases, which at that time included almost all of the known instances of the disease.

It has been my fortune to see two cases which have hitherto not been published, which I will now proceed to give in detail.
Case I. R. D. — an unmarried girl, aged 19 years, living at home with her parents.

Family history: Mother & Father alive. Father who is a stone mason suffers from chronic bronchitis. Two Brothers & One Sister are alive & healthy. One aunt had swelling in the neck & went off 'in a decline'.

Previous illnesses: Until 2½ years ago, there was nothing of importance other than Rheumatism or Syphilis. For the last 2½ years she had suffered from ‘Exophthalmic Goitre’ displaying all the usual symptoms of the disease. During this time her menstrual periods became irregular & finally ceased 5 months before the present illness. Since then they stopped however, she had suffered from periodic attacks of 'Epistaxis'.

Present illness: On June 30, 1914 she came to consult me & complained of general weakness, severe headache, sickness
and constipation; in addition she was suffering from one of her attacks of dyspepsia. On enquiry I found that she had been under treatment for some months, at the local Infirmary, for her 'Goitre.' This had been progressing favorably & on her last visit there (on June 21/94) 9 days ago, was very much better. Hurrying off to the station, however, she missed her train, & now said that she had received a chill & had felt ill ever since.

On making an examination the Symptoms of 'Enophthalmic Goitre' were found to be well marked. The Heart was enlarged & there was a systolic murmur at the base. In the Lungs, there was chronic bronchitis with purulent sputum but no consolidations.

July 4th 1944. I was called in to see the patient; I found that the general weakness was increasing, especially in the lower limbs. She was
Sitting in her chair but was quite unable to stand or walk by herself. Spasticis still continued at intervals as did also the weakness. "Today she complained of violent pains, shooting from each side of the neck down into the shoulders and arms, worse on the left side than on the right. Vision was good - the pupils were equally dilated & reacted to light. Pulse 120 + weak. "Temp. 99° F."

The weakness & spastics gradually became relieved, but the muscular weakness still progressed & attacked the upper limbs first the muscles of the shoulder & upper arm, then those of the hand & finally those of the forearm; and she was obliged to take to her bed.

July 16.

The neuralgic pains returned at intervals & today the patient had a sharp attack of palpitation & dyspnoea which lasted about 10 minutes and then passed off, leaving her in a very
exhausted condition. She also complained that her eyesight had gone and the eyeballs seemed more prominent.

July 8th.

The next morning I found that she had passed a very restless night, with delirium. I was in a very exhausted state. The lower limbs were completely paralyzed and she was lying propped up in bed. The upper arms were quite helpless, but she could with difficulty raise the forearms off the bed. The grasp of the hands was very feeble. Sensation was unimpaired. Superficial reflexes could be elicited, but ankle, Clonus, knee jerk, were absent. There was no wasting of the muscles. Her eyesight had improved, but from this time her power of vision varied from day to day. Attacks of Eysenwein came on from day to day 3 or 4 times a day.

From this time she continued to get weaker, the muscles of the trunk became gradually paralyzed.
July 16th. She could only swallow
liquid nourishment with difficulty.
The superficial reflexes had disappeared.
Her tongue became dry & brown & sordes
began to collect on the teeth.
Delirium was now almost constant.
At night she complained of pain in
the chest. Her temp. was 100° F.
Next morning (July 16th). I found she
had had a very bad night, with
restlessness, pain in the chest & attacks
of dyspnoea. Her breathing was
difficult & on auscultation the action
of the heart was found to be very laboured
& galloping. Temp. 101° F. She
gradually became worse & died at
11.30 a.m. from paralysis of respiration.

The ophthalmicacted normally till
just before death when there was
some incontinence of urine.

There was no Post Mortem Examination.
Case 2. J. W. M. — was previous to this illness a strong, healthy man, aged 23 years, married with one child, a quarryman by occupation to a well-known football player in the district, also a very temperate man.

Previous Illness.

had been restricted to obstinate constipation, slight accidents at football, one of the latter had happened four months before the present illness, when he received a kick on one shin, and a troublesome little ulcer, deeply infected and never larger than a shilling, formed and did not heal for 3 or 6 weeks.

Present Illness.

On May 20th, he was quite well but on the following morning he began to suffer from pain in the calves of his legs. These pains became so severe that he gave up work at noon. Then the pains extended through his legs and back.

Next day (May 22nd) he was worse and sent for me. He now complained...
of pain in his head (both back & front) in his back & in the muscles of his thighs & legs.

On Examination - The tongue was coated with thick white fur, the inside of his mouth was sore, the teeth were bad especially on the left side & his appetite was very poor.

The heart & lungs were round, the temperature was normal & the pulse 60 per minute.

There was slight redness of the conjunctiva & watering of the eyes. The pupils reacted to light & accommodation. There was no numbness or disturbance of ordinary sensation, & as yet no paralysis or paresis. The painful parts were not tender to pressure.

May 23rd

The pain had left his back & was localized in the back of his thighs and in the calves of his legs. Temp & normal. Pulse 60.

The eyes were still injected but there was no pain or photophobia.
A herpetic eruption had appeared on the lips. The mouth was still sore & the tongue furred.

May 24th. The patient was quite free from pain & headache. Temp. normal. Pulse 60.

He however complained of sleeplessness.

He got up at noon & dressed, but felt so weak that in 2 or 3 hours he went back to bed. His appetite had improved.

May 25th. (Onset of the Paralysis)

The patient was in bed, suffering no pain but feeling very weak. He could move his legs & toes, also his arms & hands, and his grasp was fairly good—a little stronger on the right than the left side.

He was unable to stand alone & complained of numbness in his hands & feet. He could distinguish between the head & point of a pin all over his upper & lower extremities. He was perspiring freely.

May 27th. I found the patient very weak, but his appetite was good. He was lying on his back & was unable to raise his lower extremities from the
bed, though you could see I feel the
muscles contract. He could slightly
move his foot but not his toes. The
muscles of the thigh were much more
powerful than those below the knee.
No tendon or skin reflexes could be
elicited on either side in the lower
extremities.

The upper extremities were very weak. He
could only just move his fingers; he could
close his hand but his grasp was very
feeble (practically absent). The muscles
moving the wrist were a little stronger.
The muscles of the upper arms were fairly
strong & those of the shoulder were in
good condition. The lymphatics were
normal. Perspiration was still profuse.

May 28th The patient was much
the same as on the previous day, but
had developed Facial Paralysis of the
left side. He said that his mouth
became drawn on the afternoon of the
previous day. He had had a sleepless
night; the pulse & breathing were good
Temp. 99° F. He was rather troubled
with some thick, stickly mucous in his
throat, which was with difficulty
coughed up.
May 29th At 1.30 a.m. The patient was
taken suddenly worse. He became delirious
and slightly cyanosed. Temp: 99.4° F. P. 114.
He perspired freely, and was troubled with
the mucous in his throat, which however
was not large in quantity.
His delirious during his delirium seemed
drawn to have some connection with
his paralysis, seeing that he called
upon his friends to save him from
waking through the bed or deliver
him from people who were trying to
get him down or who were suffocating him.

A mixture containing Ether, Ammonia &
Brandy was injected into the rectum
& in about half an hour he became
himself again. & 2 hours afterwards went
to sleep.
He was seen again at 10.30 a.m. & had
then had 3 or 4 hours sleep. He had
had a good breakfast. His limbs
were quite powerless. Pulse full & 110.
The diaphragm was paralyzed & the
breathing was intercostal in type.
There was slight cyanosis & the mucous
in the throat was still troubling him.
At 3:30 p.m. he was again taken
suddenly worse & in spite of further
injection of ether, brandy & ammonia he
did not improve. He became extremely
cyanosed & quite wet with perspiration.
Breathing 30 per minute, Pulse 110, full & regular.
There was a large quantity of thick tenacious
mucous in his throat. His extremely
weak efforts to get it up exhausted him
very much. Its removal afforded
him temporary relief, but it soon
accumulated again. The cyanosis
gradually increased, then came
failure of respiration & finally failure
of the pulse & death about 4 o'clock (p.m.)

Again I was unable to get a
post mortem examination.
I propose now to enter into a description of the disease making special reference to its pathology & causation; and in doing so must acknowledge my great indebtedness to the late Dr James Ross of Manchester, who in 1889 drew up 93 cases, but there is no doubt that 3 of them are not cases of Acute Ascending Paralysis, & so they will be left out as of no account.

On making comparison I find that my second case is very typical of the disease which may be described in the usual way as follows.

**Definition**

Acute Ascending Paralysis is essentially a condition commencing with premonitory symptoms which last for a few days. These are followed by a more or less active motor paralysis, attacking usually (but not always) the lower limbs.
first, then spreading to the upper limbs & trunk & finally, in fatal cases, proving so by paralysis of respiration. There are practically no definite sensory symptoms, no paralysis of sphincters, no fever, no (early?) electrical changes & no atrophy of the muscles.

**Premonitory Symptoms.** These usually consist of feelings of lassitude, numbness of the limbs, tingling of the toes & fingers, formication & severe lancinating pains in various parts of the body. They usually continue for a few days—from 2 to 7 days. In both my cases they lasted 4 days. Eisenlohr however records a case in which the premonitory symptoms only lasted a few hours whereas Pellegrino records one where they continued for 3 or 4 months.
Onset of the Paralysis.

This is usually of an ascending character, beginning in the lower limbs and gradually spreading to other parts of the body. The first thing that we notice is a weakness of the muscles and difficulty in moving about. This is quickly followed by paralysis of the muscles moving the legs and thighs. After this the extension of the paralysis is more irregular as we shall have to notice later; but very soon the muscles of the trunk and upper limbs become affected, and this is followed by paralysis of the muscles of the neck and pharynx. Finally in fatal cases death ensues from paralysis of the muscles of respiration. Occasionally the paralysis is somewhat descending in character, as in the case of 'Baron Cuvier', where the muscles of deglutition were the first to be attacked, followed by motor paralysis of the upper extremities, and finally of the whole body. The paralysis
is usually complete in a few days but sometimes it comes on very much more quickly & occasionally it develops more slowly.

**Sensory Symptoms**

are often stated to be entirely absent, but subjective disturbances of sensation are frequently present, and indeed, form the most striking features of the premonitory stage. Severe pains, striking to different parts of the body are often present as in both my cases (pp. 47 & 49). In addition the patients often complain of numbness (as in my 2nd case) formication, paresthesiae, and other similar conditions. These disturbances often pass off with the onset of the paralysis. As a rule Anaesthesia & Analgesia are entirely absent although in some of Rossi's Cases there is stated to have been a greater or less amount of Anaesthesia present.
Psychic Changes.

Are generally absent, but occasionally there is delirium (as in both my cases). "Russell" relates a case in which there was mental confusion, and "Reincke" gives one in which there was sleeplessness.

"Trophic Changes.

During the period of acute paralysis active wasting of the muscles is entirely absent and in fact, this forms a very important diagnostic characteristic of the disease. If fortunately the patient recovers from the attack, we may find complete recovery interfered with by wasting and paralysis of particular muscles or groups of muscles; but during the acute attack itself the muscles lie in a flaccid condition and only loose that amount of bulk which they would in case of any other acute illness.
Electrical Changes

Both the "Para- and Galvanic" reactions in the nerves and muscles are usually related to remain normal, but on investigating the cases in which they have been tested, this is not always found to be so. The results arrived at seem to be that in the majority of cases, the excitability remains normal, but that in a few instances it becomes diminished. Galvanic excitability has always been found to continue normal throughout some cases, but in a few instances it has been diminished and in one case recorded by Bernhardt, it is stated that the reaction of degeneration was obtained.

It is worthy of note however that in this case the electrical tests gave normal results for 8 days; then the reaction of degeneration becomes progressively diminished. The patient in this case partially recovered, but at the end...
of twelve months. He could not stand without support. Their double drop were feeble movements of the upper extremities.

Refluxes.

The reflexes may be present at the onset of the disease but sooner or later they disappear usually from below upwards. Their absence is usually followed by loss of the knee jerk.

Fever.

Is usually absent, but sometimes the temperature rises moderately high just before death. Very rarely we may find a more or less amount of fever continuing during the attack.

The Ophthamitis of the Bladder & Rectum usually remain intact to the end though occasionally we get paralysis of them just before death.
Other symptoms may arise in the course of the disease.

Profuse sweats, which is very often present, was well marked in my second case.

Constipation is often present and may precede the attack (as in my 2nd case), or may come on during the illness, when it is possibly due to muscular paralysis.

I might also refer here to the difficulty of vision which was manifested in my first case. Unfortunately the eyes were not examined with the ophthalmoscope, but as the condition was a variable one I think that it was due to a temporary sensory paralysis, causing congestion of the vessels of the retina, which came on from time to time during the attack.

Under the same heading we might also put the congestion of the Conjunctiva, + rose spots in the mouth which were present in my second case.
Prognosis.

Although some cases take a favorable turn, as a rule the progress is bad, and the disease runs on to a fatal termination. Both my patients died, and out of the 90 cases collected by Ross only 36 recovered.

The disease seems to be very much more fatal in females than in males for out of about 77 well-marked cases in which the phe is mentioned, 33 males died & 24 males made a complete or partial recovery whereas 16 females died & only 4 recovered.

Those cases which follow acute infectious diseases seem to be less fatal than those which arise idiopathically (i.e.) except those following small pox, which are very fatal.

The fatal termination does not necessarily depend on either the rapid onset of the disease, or the severity of the symptoms, as very
rapid & very severe cases. Sometimes recover, and less rapid & less severe cases may end in death.
In one or two cases death has occurred on the second day of the paralysis e.g. "Laudy" notes a case in which death occurred on the 2nd day. "Cornel & Lipin" mention one where it occurred on the 3rd day.

"The most fatal time however seems to be from the 5th to the 12th day of the paralysis. Sometimes a fatal termination ensues at a much later period, in the case mentioned by Remiche, where death occurred on the 28th day of the paralysis.

As a rule if the patient lives over the 12th day the outlook becomes more hopeful."
Convalescence.

If fortunately recovery occurs the improvement may begin at any stage of the paralysis, either after a few muscles only have been affected or when the paralysis has become very complete.

"Bernhardt" and "Salomow" each record a case in which improvement commenced on the second day but as a rule this is delayed for 7 or 10 days; and "Stumins" records a case in which the paralysis progressed for 6 weeks before any improvement was noticed.

It has often been observed that recovery occurs in the reverse order, and it is a good sign to see the muscles first attacked recovering their power.

The rate of recovery varies considerably. "Sorgenfrey" relates a very severe case in which there was complete recovery at the end of eleven days from the time when the improvement was first noticed.
on the other hand several cases
are recorded in which recovery from
more or less severe paralysis has been
prolonged over several months.

The recovery may be complete or only
partial. When only partial there is
usually some permanent paralysis
accompanied by atrophy of the affected
muscles.

"Cuming" relates a case, probably of
alcoholic origin, in which "main in griff"
persisted at the end of two years.

"Remhardt" gives three cases.

In one the patient could not stand
alone at the end of 12 months. He
had double ankle drop. The movements
of the upper extremities remained feeble.

In the second there was partial recovery
in two months.

In the third case there was very incomplete
recovery in two months accompanied
by Atrophy of the muscles of the hands.

It is interesting to note that three of these cases embrace all those which recovered as mentioned in Ross's Table, where the paralysis was put down as being caused by alcohol.

The fourth (Bernhardt 1st case) also probably occurred in an alcoholic subject.

Two cases in Ross's Table, which are stated to be of alcoholic origin died.

This would lead us to conclude that alcoholic cases are less likely to prove at all fatal than those of different origin but the chances of 'complete' recovery are much less in alcoholic than in non-alcoholic subjects.
Diagnosis.

The greatest difficulty in making a diagnosis is found in the premonitory stages of the illness. Then we might mistake it for an impending attack of Influenza, or Subacute Rheumatism. But the usual absence of fever and the subsequent development of the condition will generally enable us to eliminate those diseases. When the paralysis is actually developing there will be much less difficulty. The absence of definite sensory changes, fever, paralysis of the sphincters or active atrophy of the muscles, together with the normal electrical reactions will generally be sufficient to enable us to recognise the disease.

The other conditions with which it might be confused are various changes in the Spinal Cord.
1. Acute & Sub Acute Anterior Pleromyelitis

In this disease the paralysis is at a maximum from the first. After this it does not tend to progress to a fatal termination, but usually becomes arrested. There is more or less rapid atrophy of the muscles and electrical changes come on early.

2. Acute Central Myelitis

In this disease, in addition to motor paralysis we have very rapid loss of sensation, paralysis of the sphincters very early, early electrical changes.


Here the attack comes on very suddenly. At first there are symptoms of spinal irritation—muscular spasm &c.

Then the paralysis follows both motor & sensory below the seat of the haemorrhage.

There is also paralysis of the sphincters.
4. Spanish Apoplexy

'Stuporose into the substance of the Cord'. The onset is very acute accompanied by violent pain, anaesthesia below the lesion & paralysis of the sphincters.

5. Syphilitic Paralysis

This may sometimes present difficulties, but the class of the patient, her surroundings, her peculiar temperament the favorable course of the illness will enable us to come to a right conclusion
Etiology and Pathology

I now come to a consideration of the various views which have been advanced as to the nature and causation of the disease.

Acute ascending paralysis seems to be a disease of early and middle adult life, the majority of cases occurring between the ages of 20 to 50 years; but Möbius relates a case following a severe attack of whooping cough in a child of 3 years; and "Gombault" gives one in which the patient was 67 years old.

It is far more common in men than in women for out of the 77 well-marked cases already mentioned (see Prognosis, p. 21) 57 were males and only 20 were females.

It also seems to affect chiefly people of the working classes and those who lead an irregular life.
Exciting Causes.

These will have to be considered in more detail later on; but I may say here that several cases have followed upon infectious diseases; others upon the presence of chemical poisons in the system. Many are said to have arisen from exposure to cold or sexual excesses; and in some no cause whatever is assigned.

As has already been mentioned, the disease was first recognised by Landry in 1859, and at a time when diseases of the Spinal Cord were rapidly being differentiated from each other; it was looked upon as of Spinal origin. One put it down as a variety of this or that form of already known Spinal Inflammation. Others insisted and rightly that it
was quite a distinct & separate disease; but all post mortem examinations, both
naked eye & microscopical, of the cord failed to bring to light any definite
changes in its structure. 

True, there have been abnormalities
recurring occasionally in the cord.

Out of 38 cases, in which the Brain &
Spinal Cord were examined either
by the naked eye or microscopically.
Some changes were found in 17 instances;
but these changes were usually so
slight and so variable in character
that it is difficult to look upon
them as essential to the disease.

"They consisted for the most part of
such things as,

1) Congestion of Cerebral and Spinal
Membranes, which has been noted
in cases by "Alliower", "Zirouy", & "Chalvert"

2) Patches of Softening in Various
parts of the Cord in cases recorded
by "Walpole", "Harley & Clarke" & "Corveil & Repin"

3. Cell infiltration & granular deposits in various parts of the cord as noted by "Leyden"

4. Segmentation & swelling of some ganglion cells, atrophy of others; with swelling of axis cylinders of nerve fibres in certain foci of myelitis ("Beldew & Leyden")

5. Changes in the lateral columns and anterior horns, with swelling & vacuolation of ganglion cells. ("Schulte & Schultze")

6. Slight haemorrhages into the cord. ("For"; "Immermann")

7. Meningitis & Bulbo-menigitis but no changes in the cord itself ("Hoffmann")

& ctc.
Many of these changes may have been due to accidental complications or may be additional results of some primary disease such as 'Syphilis'.

Very often in well marked examples of the disease absolutely no organic changes have been found in the brain or spinal cord. E.g. "Birnbaums" records a case in a man aged 29 years. The patient had suffered from a mild attack of Smallpox with Convalescence on the 8th day. Two days later paresis commenced and extended to complete paralysis in 6 days, and 3 days later the patient died from Asphyxia. Electrical reactions were normal and on post mortem examination (microscopic), the medulla, cord, nerve roots and nerve trunks were found to be normal.

Such being the case the supporters of the spinal theory had to fall back upon a functional or Physiological Explanation.
"Wells" in 1883, in his "Lectures on Diseases of the Nervous System" puts the case very well. He says, (page 273)

"It (Landry's Paralysis) is of extreme interest, as it may be simply the result of a condition of the cord which is physiological rather than pathological. A mere loss of function arising from some inhibitory action, which may cause a fatal ending before this inactivity is recovered from.

Whatever its nature may be, the rapidity of its extension is most remarkable, for it propagates itself from end to end like wildfire.

Here we see implanted a firm belief that the condition begins at one end of the cord (usually the bottom) and spreads more or less quickly through it to the other end."
But does a careful study of the symptoms of the disease bear out this view?

If the condition is one of true anatomical ascending (or descending) paralysis then the muscles should be attacked in the order in which they are innervated from the central nervous system.

An examination of the cases however reveals great & frequent irregularities. In this order, "Landy" himself states that the muscles are attacked in the following order:

1. The muscles which move the toes and feet, then the posterior muscles of the thigh & pelvis and lastly the anterior & internal muscles of the thigh.

2. The muscles moving the fingers, the hand & the arm upon the scapula and lastly the forearm upon the hand.

3. The muscles of the trunk

4. The muscles of Respiration and then those of the tongue, pharynx and esophagus.

(Quoted by Rose, M.M.C. Vol XI, p. 89)
We cannot say that this, which perhaps fairly correctly represents the usual course of events, is anatomically a true ascending paralysis.

Still greater variations have several times been noted. In the Cases of "Cuming" and "Bernhardt" already mentioned (page 24) the upper limbs were attacked before the lower ones.

"Piloux" relates a case following an attack of small pox, in which symptoms of bulbary paralysis were the first to appear; these were followed by paralysis of the lower limbs & afterwards by feebleness of the upper limbs.

"Westphal" relates a case in which the upper limbs & muscles supplied by the bulbary nerves were attacked simultaneously.

In another of "Bernhardt's" Cases the upper & lower limbs & pharyngeal muscles were all invaded at the same time.

Even in the limbs themselves there is no definite order in which the muscles..
are attacked.

In my 1st Case the paralysis first affected the muscles moving the upper arm, and then those moving the fingers; & afterwards those moving the forearm.

In my 2nd Case there was first paralysis of the muscles of the fingers, then of those of the forearm & upper arm.

The Dyaphonia may be first accounted for, sometimes by paralysis of the intercostal muscles, sometimes by paralysis of the diaphragm.

Many more cases could be quoted of a similar kind, but those already mentioned will be sufficient to show that very often the order of paralysis is of a very irregular nature; and that the conditions can only be called 'ascending' so far as it describes the usual manner in which the paralysis spreads from the extremities towards the centre, and not with reference to its upward march.
through the spinal cord.

In short we may conveniently speak of it as "ascending" clinically but not anatomically.

Seeing that the Spinal theory is not supported by sufficient weight of evidence it is not surprising that people began to look elsewhere for the cause of the disease, and of late years "Landry's Paralysis" has been regarded by many investigators as due to a 'Peripheral Neuropathy'.

This is the view which the late Professor James Ross advocated in the series of Papers already alluded to which appeared in the Manchester Medical Chronicle vol XXI, 1889-90.
In support of this view he quotes the 9 cases in his tables, in which the peripheral nerves & nerve roots were examined.

In 6 of these degenerated fibres & other evidence of neuritis were found in some peripheral nerves or nerve roots; while in the remaining 3 the nerves or nerve roots examined were found to be normal.

He then goes on to argue that from post mortem changes there is more presumptive evidence of the disease nerve being due to peripheral causes than to spinal causes, because we find nerve & nerve root changes in 6 out of a total 9 cases examined, whereas there were only spinal changes in 14 out of a total 38 cases examined (see page 31).

When in very acute cases we may find no post mortem evidence of neuritis (because he says it has not had time to develop), he continues:

"The evidence in its favour is to be..."
found not in microscopical investigations but in the essential identity of the causation and clinical phenomena of these cases with others which pursue a more or less chronic course and in which degenerative changes have been observed in the nerves" (M.M.C. Vol. 11, page 100).

In investigating these 9 cases in which the nerves and nerve roots were examined I doubt whether his evidence is so very strong as to Peripheral neuritis being the primary cause of "Acute Ascending Paralysis" as he tries to make out.

The three cases in which the nerves and nerve roots were normal (and let it be noted the cord also) are related by Pellegrino — where the paralysis lasted 12 days.

of Bablow — where the paralysis lasted 13 days — only lasted 1 eye examination.
(4.) 3. Bernhardt - where the paralysis lasted 3 days.

The six cases in which changes were observed were related by

"Gombault".

In this case the paralysis lasted 5 days. Convalescence was prolonged and the patient died 7 years later from cancer of the abdomen.

On post mortem examination the Ganglion Cells of the Anterior Horns of the Cord were found to be globular and contained excess of pigment. There were also degenerative fibres in some of the anterior roots and islets of Sclerosis with excess of Connective tissue in the peripheral nerves.

It would be very difficult to say that the changes found either in the cord or nerves, had been the primary cause of the paralysis occurring 7 years previously. These changes may just as likely have been secondary or subsequent to the attack.
2/ Degerme & Goebi

give a case in which the patient suffered from premonitory symptoms for 2 days and the paralysis only lasted 3 days. Yet, after this very short time, on post mortem examination there were found well marked degenerated fibres with multiplication of nuclei in some anterior nerve roots.

This patient had contracted syphilis 14 years previously, and it is far more likely that the changes were ordinary syphilitic effects than a primary neuritis which caused the Acute Paralysis which would have hardly become so well marked in so short a time.

3/ Schulz & Schultze

In addition to changes in the Cord (see page 32) minor changes were also noticed in the peripheral nerves.

Here again the person suffered from syphilis which possibly accounted for alterations in both the nerves.
and the cord. At any rate if we are not to allow that the cord changes were responsible for the paralysis, why should we allow that the nerve changes might cause it (i.e. on P.M. evidence)?

"Vivien Heyden"

Here the chief changes were in the cord (see page 32). I noticed changes in the nerve trunks. In this case the premonitory symptoms lasted 2 months & the paralysis 3 days. Although there is no direct evidence of syphilis in this case, it is noted that the patient had suffered 3 years previously from ulcerated legs, which are often syphilitic. Here then the changes in the nervous tissues may have been previous syphilitic ones.
This only leaves 2 cases not yet mentioned of these

"Leendel" relates one. — The case of a man who while drunk tried to commit suicide by inhaling the fumes of burning charcoal.

Paralysis lasted 13 days and on post mortem examination the cord was found normal but there was neuritis of the Great Sacral Nerve (which had been painful during the illness).

"Westphal" records the other one in a man aged 33 years. The invasion lasted 12 days and the paralysis 32 days. It followed an attack of diphtheria.

On post mortem examination the cord was found to be normal but the Anterior Cerebral Nerve showed changes similar to those found in the musculo-spiral nerve in a case of lead paralysis.

In both these cases the Spinal Cord
was found to be normal.

In both however secondary neuritis had had time to develop after the onset of the paralysis.

In lecture case there may have been neuritis before the paralysis being that the patient was evidently alcoholic; if not carbonic oxide is a very rapid poison which could soon set up a secondary neuritis; so in the other case the paralysis was protracted over 32 days during which well marked changes had time to develop.

But if my suggestions with reference to the other four are accepted it shatters very considerably the evidence on which Ross bases out his case for a Primary Arfheine neuritis as the Cause of Landry's Paralysis.
While fully admitting that Peripheral neuritis may be found subsequent to an attack of Landry's Paralyse (and we have very good evidence both post mortem & clinical that it is) I think that we must look elsewhere for the Primary Cause of the Disease.

Indeed it has been contended of late years that there is no such thing as a 'Primary Peripheral neuritis'; the argument being that as a nerve is a purely conductive and passive agent, depending for its nutrition on its peripheral or spinal trophic centres any inflammation which affects it must be Secondary to affections of those centres.

Instead then of looking either to the spinal cord or the peripheral nerves, I venture to suggest that in the presence of poisons or substances (either organic or chemical) in the blood we may find the essential cause of the disease.
In following out this idea we will first see what evidence we have of the presence of these poisonous substances.

Out of 40 cases which Ross has collected together 13 occurred during the convalescence from infectious diseases. viz. Small Pox 5.

Diphtheria 1.

Whooping Cough 1 (which Ross himself may have been complicated by Diphtheria).

Four cases followed upon Pneumonia which had been treated by bleeding, emetics & blistering.

It will be necessary to mention these in rather more detail. They were related by J. Landry.

After several febrile attacks, the patient had Pneumonia & was treated by 3 bleedings, emetics & blistering. There was an imperfect recovery.
and 3 month afterwards, he was dead with the paralysis.

(2) "Sendel"

Double Pneumonia was treated by Darl Emetic & Blisters. The blistered surface over the chest was ulcerated but was not covered by a white membrane.

3) "Gubbi"

Double Pneumonia was treated by 4 bleedings, large doses of Emetics & two blisters. The blistered surfaces continued to exsanguinate for a long time.

"The probability is that, in the weak & exhausted condition of these three patients, the blistered surfaces became the seat of septic invasion."
A woman ill lodged and ill nourished was seized with Pneumonia of the Right base. She was treated by large doses of some other large stimulants. The patient became convalescent, but the blistered surface did not heal. They continued to suppurate and became covered with a white exudation.

I think there is very little doubt that in this case the blistered surface became infected with Diphtheria.

Eight cases occurred in people suffering from Diphtheria and one in a man affected with Tuberculosis.

Barry of Manchester

Record a case in which a man was rubbed on the cheek with fat from a horse which was supposed to have died of Splenic Fever three weeks before. He was seized with
paralysis and died.

In examinations organs were found in
the blood similar to those in the blood
of a horse dead of Spurce Fever.

"Brasowe & Bosley"

"gave a case where a man
was bitten by a rabid cat. Symptoms
of paralysis began 6 weeks after the bite.
Inoculation of Rabbit with virus from

"Brandly"

"gives another case where the paralysis
was of an 'Intermittent Ascending Character'
was cured by Quinine. This was
probably Malaria.

Two Cases (by Oliver & Landry) are
said to have followed normal confinement,
but it is possible that here there was
some Septic infection.

"Gomes do Valle"

"gives a case which is Paris
To have followed ordinary Pneumonia
the attack however was very prolonged
and diarrhoea persisted for many
months. As this case occurred in a
military man who had suffered from
Yellow Fever (and had hence probably
been in the tropics) The pneumonia may
have been a complication of Typhoid
or Dysentery — at any rate. The
illness and subsequent paralysis
were probably organo-mal in origin

This gives 32 cases out of 90 in which
we may say with some degree of
certainty that organisms of their toxic
products were probably present in the
blood.
Coming now to consider another group, we find that 11 cases are said to have been caused by some chemical agent or other.

Five cases (related by Cumming, Bernhardt, For. Pinney, and Myrtle) respectively are attributed to alcoholic excess; being that a sub-acute form of paralysis is commonly caused by alcohol there is no reason for doubting but that under certain circumstances an acute paralysis may follow its excessive use.

In "Lentil" case already mentioned (page 44) the paralysis was no doubt due to the poisonous effect of carbolic oxide which very quickly produces profound alterations in the condition of the blood.

"Nethli" relates two cases following poisoning by corrosive sublimate.

"Russell" record a case in a gentleman
ofsyntax habits who had suffered from worry & mental & bodily exertion.
Ross does not accept the syntax Poison as the cause of the Paralysis but suggests that probably Alcohol was the Cause seeing that Soul is often due to indulgence in Alcohol, the circumstances make it possible that the Man had been finding solace in it from his worries.
but either one or the other cause is sufficient for my purpose.

Two Cases are said to have been Caused by Rheumatism but the evidence of it does not seem to have been very well marked in either instance.

In the One Case related by "Galletri", the patient was a foreman who was exposed to change of temperature. He had suffered from some lung affection and later from Acute Rheumatism with cardiac complications.

One of the symptoms of the attack was Pain along the vertebral Column, and
The suggests a possibility of an alcoholic complication.

The other case (supposed rheumatic) is related by "Levy". The attack began with headache, vertigo, vomiting, which points rather to some specific feverish attack than to rheumatism, but the cause must be left in doubt from the meagre description supplied.

Hence we get 10 cases in which there was probably some chemical poison in the blood, if we consider the case given by "Levy" as of organomac origin. We have 20 out of 30 out of 90 cases, in which we have demonstrated the presence of some poison in the system.
Of the remaining 44 cases, 13 are said to have arisen from exposure to cold, 2 from suppression of menses, 5 from sexual excesses & in 29 no cause is assigned.

It is very doubtful whether such things as a chill, sexual excesses, or suppression of menses are, of themselves, such potent factors in the causation of disease as some people make out. Very often they are the refuge of the destitute, and are given without any true scientific reasons to back them up.

"Pooh" thinks that several of these 44 cases may really have been due to other causes & especially to Alcoholic Excess.

He suggests this latter as a cause (if)

1. The occupation of the patient exposes him to the temptation of frequent drinking.

2. If the patient has led an irregular
life in other ways.

(1) 3/ The lass suffered from profuse sweats

(2) 4/ The lass suffered from a previous

attack from which he has made a

partial or complete recovery.

(3) 5/ The attack has begun at the end

of December or beginning of January

(See further reason)

(4) 6/ In the description of the symptoms

mention is made of the presence of

tenderness of the muscles, elicited

either on pressure over them or on

voluntary exertion.

(5) 7/ Tremors are one of the symptoms.

(6) 8/ In the progress of the paralysis, bulbar

symptoms are either absent or occupy

an subordinate position.

(7) 9/ The paralysis has pursued a

Comparatively favorable course.

(M.M. C. Vol X page 453)

I do not propose to enter into a

discussion of these conclusions, but will

leave them as they stand.
Mr. (Ross) finally sums up the analysis of his 90 cases, so far as their cause is concerned as follows:

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Pox</td>
<td>5</td>
</tr>
<tr>
<td>Lymphoid</td>
<td>4</td>
</tr>
<tr>
<td>Measles</td>
<td>2</td>
</tr>
<tr>
<td>Syphilis</td>
<td>8</td>
</tr>
<tr>
<td>Tubercle</td>
<td>1</td>
</tr>
<tr>
<td>Perpetual State</td>
<td>2</td>
</tr>
<tr>
<td>Malaria</td>
<td>1</td>
</tr>
<tr>
<td>Spleen Fever</td>
<td>1</td>
</tr>
<tr>
<td>Rabies</td>
<td>1</td>
</tr>
<tr>
<td>Diphtheria or Seplemenum</td>
<td>8</td>
</tr>
<tr>
<td>Alcoholic Excess</td>
<td>1/2</td>
</tr>
<tr>
<td>Percloide of Mercury</td>
<td>2</td>
</tr>
<tr>
<td>Carbonic Oxide</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
</tr>
</tbody>
</table>
I imagine that sometimes the cause of the disease has been overlooked, either through insufficient inquiries being made, or because really important points have been considered too trivial to be worthy of notice.

In this connection I would refer to the disease "Tetanus." Originally considered to be of spinal origin, it has since been proved to be caused by wound infection, and yet the wound may have been so trivial as almost to have been forgotten—a prick from a thorn or a scratch on the thumb.

We may look upon Tetanus as the exact counterpart of Landry's Palsy—-the one causing violent spasmodic contraction of the muscles, the other a rapidly extending paralysis.

I think that my own 2nd Case is very instructive in this respect.

For a stranger, with no previous knowledge
of the patient, it would have been very difficult to have assigned a cause for the paralysis, except the convenient chill, or exposure to cold, especially when the man's occupation of a Quarryman was taken into consideration.

Read alongside such a disease as Ilanitis, however, the troublesome little ulcer on the shin from which he suffered a few weeks before the attack acquires special significance. I have little doubt that, since the ulcer did not heal for 5 or 6 weeks, it became the seat of some retrograde wound infection, the toxic products of which acquired an accumulative effect which ultimately gave rise to the very typical attack of Landry's Paralysis.

If this is so the Case can be classed along with those already mentioned, which have followed upon Pneumonia treated by blister.
In my first case there is every reason to believe that the case was the subject of Tuberculosis, which in the already weakened state of health caused by the spate proved sufficient to precipitate the attack of "Acute Ascending Paralysis."

While dealing with this part of the subject it may be interesting to mention a case (hitherto unpublished) which occurred in the practice of a friend of mine. It is interesting because of the way in which a localized wound infection gave rise to a clinically typical "Acute Ascending Paralysis."

The patient was a man aged about 23 yrs, who was operated upon in July 193 for left hydrops nephrosis. The kidney was ligatured and the kidney and pae removed. The wound healed in 10 days and all went well for a time; but soon pus pointed at the wound & the abscess
was opened & syringed out regularly.

On Sept 27th, there was a rise of temperature
and some fever of the wound. There
was also some slight stiffness of the
back of the neck but no pain
Sept 4th. Temp 101° F. There was considerable
weakness of the legs but sensation was
good
Sept 5th. Increased paresis of the legs the
patient could hardly move them
Sept 16th. The legs were almost completely
useless, the hand grasp was feeble and
there was drop foot (no lead). Abdominal
reflexes were present, but those lower down
had disappeared. Sensation was normal
Sphincters normal.
Sept 29th. Temperature normal. The lower limbs
were completely paralyzed and the upper
limbs (especially the extensors of the forearm)
were very weak. Abdominal reflexes were
absent, sensation was normal. The sphincters
were intact. The diaphragm and
Intravascular bruits were normal
About this time there was found to be a communication between the wound and the bladder, and lotion was freely syringed from one to the other.

From about this time improvement commenced. Sept 1st.

There was slight movement in the upper limbs. Abdominal reflexes could again be elicited.

April 29th. Slight improvement in the flexors of the thighs.

Convalescence was very protracted however. April 96. There was very little movement below the knee though the arms were much better.

August 23rd. The patient can now walk with assistance. The arms are quite recovered. The wound has been healed for 6 or 8 weeks.

During the onset of the paralysis long rod shaped bacilli (as large as the Anthrax Bacillus) were found in the urine I persisted for several months, and I think that these Bacilli, acquired by
Wound infection, and causing at first the rise of temperature & fever of the wound, were the probable cause of the subsequent paralysis.

"To sum up our results so far:"

Out of 90 cases collected by 'Roes', some cause or other is assigned for the disease in 63 of them.

Out of the 63 cases, some poison, either organic or chemical, can be traced in 43 instances. In the remaining 20 cases, the cause assigned such as chill, sexual causes & suppression of menses must be considered as insufficient, and if more extensive inquiries had been made some more definite reason might have been found to account for the paralysis.

Indeed 'Roes' suggest that there
is strong presumptive evidence that a definite poisonous cause can be traced in several more of the cases, and finally as already stated (page 58) give 53 as due to some form of poison out of the total 90 cases, leaving 37 as arising from unknown causes.

Adding to these the three cases which are related here for the first time, and in all of which I have traced the probable presence of organisms, the weight of evidence points to "Acute Ascending Paralysis being of Peripheral origin and its Primary Cause the presence of Animal or Chemical Poisons circulating in the Blood."
Coming to a consideration of the manner in which the toxic products bring about the paralysis we find ourselves confronted with many difficulties.

As I have tried to show there are many objections to the views which have been held in the past and our present knowledge of the subject is so incomplete that any new explanation must be in great part conjectural.

What is certain, however, is the fact that in many well marked and severe fatal cases, absolutely no anatomical changes have been discovered in the nervous system either central or peripheral even on the most minute microscopic examination (see page 33).

Such being the case I think it very reasonable to assume that changes in these tissues are not essential factors in the causation of the disease.
Which is to some extent physiological rather than anatomical and in doing so would remind you of the action of "Curare" when injected into the blood.

"Curare" paralyses the peripheral terminations of motor nerves, especially voluntary motor nerves (Rutherford) and I would suggest that under certain peculiar circumstances of the system (which require investigation) the toxic agents, which we have been considering, are similarly capable of paralysing the peripheral terminations of motor nerves.

I am not able to bring forward any definite proofs of this suggestion, but I think that it offers a reasonable explanation of the phenomena of "landry's paralysis" and does away with many objections which have been advanced to other theories.

Personally I have not seen this suggestion previously, and think that it might open up a new field for investigation.
If this paralysis of nerve endings is very profound, then the involuntary motor nerve fibres of the heart become involved and death ensues.

If less profound, the involuntary motor nerve fibres resist the attack & gradually the paralysis passes off.

In the paralysed condition of the motor nerve endings I think it possible that by some means or other the poisonous products may sometimes find their way into the nervous tissues and give rise to secondary changes in the peripheral nerves & also in the spinal cord & medulla; these changes, if death does not ensue, being accompanied by the usual alterations in electrical reactions, by muscular atrophy, by protracted convalescence & sometimes by imperfect recovery.
In this connection the results of a
Post mortem examination made by
"Cantarni" in a typical case of
Landry's Paralysis are interesting. They
are summarised in the Manchester
Medical Chronicle Vol XI page 368
as follows:

"The essential changes in acute
ascending Paralysis are found in the
nerves, in the form of an acute
intradural neuritis (i.e.)
Changes can be found in the spinal
cord though only very slight and in
a certain measure, indirect.
In all the peripheral nerves bacilli are
found in great numbers with
special characters and localisations. When
claimed according to Jahn's method,
with rosea methylene blue, they
appear as rods of regular cylindrical
form with rounded ends, without
spores or without special arrangement.
They occur almost exclusively in the
endo neural lymph space which
surround the sheath of Schwann."
They are absent in the rest of the nervous system & also in the muscles.

In a case related by "Curschmann" which occurred in the course of an attack of "Typhoid Fever", a microscopical examination of the cord revealed the presence of "Typhoid Bacilli" scattered throughout the white substance and sometimes forming small masses. The bacilli were cultivated and communicated the characteristic disease to mice & rabbits.

While not admitting as proved that their presence in the nervous tissues was the primary cause of the paralysis these two cases show that Bacilli can penetrate directly into nervous tissue & set up Changes there.
Briefly summarized my conclusions are

Acute Ascending Paralysis

is as a rule a rapidly fatal disease, taking the form of a General motor paralysis, probably caused by toxic agents in the blood (an acute anaemia), possibly brought about owing to paralysis of peripheral motor nerve endings, and sometimes followed by peripheral neuritis & degenerative changes in the Cord and Medulla.
I have not read anything about the treatment of the Disease because at present most drugs which have been tried (often empirically) seem to have had very little effect on the acute course of the Paralysis; unless indeed we can find a definite cause which is amenable to treatment such as "Malaria" or "Syphilis."

April 1897.

MELTHAM