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Alfred Sykes-Ward
M.B. F.R.C.P.

41 Queen's Walk
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Chronic Muscular Atrophy

Progressive Muscular Atrophy is a chronic disease of the voluntary muscles, attacking either groups of muscles or individual muscles.

This disease has been recognised from the time of Hippocrates. The distinction between paralysis with and without atrophy of the muscles, progressive atrophy without paralysis, has been described in the early part of the century, but was not recognised as a distinct lesion.

In 1860 Duchenne and others gave a description of this affection, which first entitled it to be considered a distinct disease. In 1858 Sir William Gowers collected all information known up to that time in an essay called "Huntington's Disease." Since then investigations have been made by Bechter, Hall, Friedrich, and others.

Teratology.

Heredity is generally considered a powerful factor in producing this...
Disease: Perfect (wasting Palsy). Reynolds, System of Medicine, vol. 2, p. 335, 1878. Collected the history of ten families, in whom a tendency to wasting palsy prevailed; in four of these families the disease was confined to two brothers in each. Altogether these ten families included twenty-nine individuals, inspected, of which only four were females. The cases described by Dr. Mouzon which are included in this list were shown jointly instances of the advanced state of wasting. He partook the muscular paralysis. Excluding these latter twenty-three were affected, 4 of these 23 were females (Mrs. Diseases of Nervous System, p. 938, 1st. ed.).

Phrast (Seins de nos Maladies, Systeme Hippocratic, vol. 2, 1st. ed.) states that Paquin relates the history of a family where the transmission could be followed through five generations. Other (loc. cit.) states that cases arising from hereditary influence, present another well-marked feature in nearly all of them, the disease.
Became generalized and consequently tended to a fatal termination. In this regard it the influence of age, young adults and middle aged persons are more liable to the disease, though well marked cases have been observed in children and old people.

The disproportion between the frequency of occurrence in men and women seems to be the result of the greater and more prolonged muscular exertion required by the work of the former. When men and women follow the same occupation, for instance washing, the higher percentage of men still continues.

To account for the comparative immunity of women (Ross, M. 1793): "Darwin has shown that many variations which just appear in one sex are transmitted to that sex only.

Measles, Rheumatic fever, Cholera are also stated as causes. Throat has also obtained its move child-birth. Various excesses have been stated by many
Immediate Causes.

Of the immediate causes, muscular relaxation appears to be the most important, as it has been shown that atrophy, these muscles or groups of muscles which, by reason of their various usages, are kept in a state of long continued contraction, as in blacksmiths, tailors, and others. For the same reason the lumbar muscles of children are very frequently the first affected. Prolonged exposure to cold is another exciting cause and in these so-called rheumatic or neuralgic pains are observed. In this class of cases, Roberts, (Regnier, Syll. of Med., P. 336 No. 2) states that the invasion is sudden, without warning and accompanied by cramps and twitches of the muscles. Atrophy has been observed to follow injuries of the spinal column, as in a case mentioned by Roberts, where a fall of a stone fell on the neck of a man, who ultimately died of this disease. Local injuries to the muscles have
been followed by progressive muscular atrophy and in the case reported by Friedreich was finally complicated by bulbar paralysis. A form of muscular atrophy follows lead poisoning and occurs amongst brass-workers (Suckling, Brit. Med. Jour., Dec. 15th 1884.) It is also peculiarly common amongst brass-workers.

The following is a case which I have had under my care for eight months and which appears to be a good example of this disease; especially as it occurred in a female, and is also of interest on account of the existence of the disease for many years.

**History**

Mrs. B., aged 54, married. Her father died of apoplexy aged 47. Her mother died from phthisis aged 65. Five brothers and three sisters all died of phthisis under the age of 30. One brother and one sister living in good health. Mrs. B. was nurse at a large brass-patience establishment and had a great amount of hard work, lifting heavy weights, patients, etc. A double hemiplegia was produced by this. Afterward...
The was a laundress I had a heavy example to form.
There is no history of Syphilis previous illnesses.
When she was 28 years of age, she fell down suddenly & lost her speech. She retained consciousness. The Aphasias lasted for three days.
The states there was no loss of power in any of the extremities.
This illness lasted for fourteen weeks. Ten years afterwards, she had Diaplegia 1st before and after the birth of her second child.
Two years subsequently, she and her husband both suffered from lead poisoning of which the pre-dominant symptoms were acute blue line on the gums & severe facial neuralgia. For this reason, she had a variety of treatment under numerous doctors, including the removal of twenty teeth at one sitting. At this time, she inflicted the lost flesh through the did not receive any particular loss of power. Before this she was a stout well-made woman.
Twelve years ago she first indeed.
that she had great difficulty in raising her right arm from her side. Two years later, she lost the use of her right hand and forearm. Two years subsequently, the right leg was similarly affected first the muscles of the thigh, and spreading gradually down the leg. This was followed shortly by atrophy of the muscles of the thigh and by loss of power in the left arm and leg accompanied by shooting pains. She was now quite crippled and was not able to lie in bed. There was no loss of coordination.

Present Condition
I was called to see her on June 27th 1888 and found her suffering from pain in the left arm of some weeks duration. On examination I found the muscles of the right hand, the interossei of the muscles of the femur and thigh thenar muscles atrophied. The thumb was held in a line with the first metacarpal bone and could not be flexed across the palm. Fibrillar contractions
were visible and the hand assumed a poodle claw-like appearance (man in poodle). The muscles of the right forearm were all extensively wasted, especially the flexors and extensors. In the upper arm the muscles were generally affected, especially the Brachialis Anticus, Biceps and Triceps. The arm had a flattened appearance. She could hardly raise the arm from the side, which hung in a position rather towards the front of the trunk, and closely pressed to the side.

When the arms were folded in front of the chest, the inferior angle of the right scapula was one and a half inches from the spinal column, the left inferior angle was about two and a half inches. When the arms hung down naturally, the posterior borders of the scapulae projected backwards an inch from the body. When they were held horizontally forwards the posterior borders of both scapulae projected backwards one and a half inches from the chest.
Wall and approached in the space
planar within two inches of each
other leaving a deep space between
them. The fingers could be easily
inserted between the scapula and
the chest wall. The supra-spinous,
supra-epaulet, the scapular &
spinous were also much atrophied
when the shoulders were drawn
back, the elbows pressed to the
deltoid, pressed so that the fingers
pointed up with the palms
forward, the superior angles of
the scapulae were brought together
in a plane about an inch and
a half behind the spinal column.
The latissimus dorsi of the right
side was greatly wasted, on the
left it was not as much affected.
The muscles of the back in the
cubital region were much atrophied
the Erectores Spinae being markedly
affected. The muscles of the
thorax were much flattened &
had lost their roundness
in the case of the left forearm
and upper arm, the knuckles
were much in the same condition
as those of the right.
such an extent. The deltoid was still much affected and the arm could be raised from the side with comparative ease. In the hand the thenar and hypothenar eminences were considerably affected. The thumb could not properly be flexed over the palm but there was a lateral dislocation between the first phalanx and the metacarpal bone, by which means when the thumb was abductated, it could be flexed across the palm. There was a scar at the inner and lateral aspect of the first phalanx. The patient cannot distinctly remember when the first indented this dislocating but thinks it occurred during the last twelve months and does not think the scar had any connection with it. The interdigital were slightly affected, particularly the first dorsal. The terminal phalanges of the proper toe were hirs. A form upon the second phalanges(Figular protrusion) were well marked. The dislocated
Joint was considerably enlarged. The pectoral muscles of both sides were considerably atrophied. The serratus magnus of the right side being especially so, the ribs being very prominent, its fellow on the left side was less affected. The pectoralis major and minor on each side were reduced in bulk on percussion, the costal cartilages feltullen contraction, were visible.

The lower extremities were more what deceptive in appearance I did not show such a marked atrophy of the muscles as ought have been expected from the complete inactivity. To walk this was caused by a considerable increase of fatty tissue in the thighs and arms, below the knee, as well as these being considerable atrophy about the legs and feet. In the right leg, there was increased knee-jerk and ankle clonus, with inability to bend the ankle in the leg. In this extremity there was a tendency
By having the foot on the ground when attempting to walk, by bending the ankle jointly there was an apparent increase of tension in the muscles of the calf. In the left leg the knee-jerk was diminished and ankle-clonus not present.

The measurement round the right calf was 13 1/2 inches and round the forehead of the right thigh 18 inches. Round the left calf 12 1/2 inches, left thigh 18 inches.

The patient could not move or separate the toes of either foot. When sitting down she had very great difficulty in rising, and could only do so by holding fast of a table or chair with her hands. It even then was difficult for her to get herself into a erect position. Was a matter of very great exertion. When in bed on her back she was quite unable to raise herself into a sitting position or to turn over. If put on her face she was completely helpless and cried out more from that position.
The head had been raised up and arms down.

Soreness in the right side and had been present at intervals for two years.

The large amount of general heaviness was reducible on the left side, but only partially so on the right. Tender spots were found in the perineum on the right and seventh cervical and second lumbar vertebrae. Tenderness in considerable extent was complained.

**Electrical reaction.**

The electrical reaction of the muscles to the faradic current was diminished especially in the right upper extremity, in the lumbar muscles and also in the lower extremities. The same with regard to the constant current. There was no reaction of degeneration. The patient would not consent to the removal of a portion of one of the muscles for microscopic examination.
Sensibility

The sensibility was normal with the exception of the then of the right hand, the left arm and the back which she felt "as if they were dead." She suffered from severe plantsanal pain in the legs and left arm and also had some severe attacks of dysesthesia facialis.

Paresis was complained of especially in the face and pupillary symptoms.

The pupils were rather contracted with accommodation to light, and the right easily began to fail. Slit of pupils present in the left eye.

Heartbreak

The treatment at first consisted of Podophyllin of M. Nash, 30 p. being taken during the day with flistines over the tender spots on the spine. Under this treatment the my 23 showroom showed signs of improvement and also to some extent regained the use of her legs. Finding this to be the case I then ordered a course of massage.
And the Faradic current. The massage is to be continued for three months from three times a week. The electricity has been continued up to date and will still be continued. As regards the Faradic current, it has been applied both to the individual muscles and also to the spinal column, the current being allowed to pass down the whole length of the cord. The nodules of Phæochromia had to be stopped after being taken for a considerable time on account of severe epistaxis. Other rare remedies used have been preparations of Iodin and Staphylica, Phosphate of Lime, and Arsenic for the diabetic condition of the right leg. Her Mitchell's treatment of muscle stretching as described in the Philadelphia Med. Press. July 23rd/87, was used for several weeks with some benefit. After having been under treatment for eight months her present state is as follows: she now feels in her general
health to be as she expressed it—
"quite well." She can walk very
fairly with the help of a stick, though
her ability to walk varies somewhat
day by day. She still lags her
right foot a little, and a small
obstacle is apt to tip her up.
She can get up and down stairs
with little difficulty and also
get out of her chair easily.
She can work a treadle sewing
machine, darn stockings, but
as yet cannot sew, though she
can pick up small objects from
the floor fairly easily. She can
turn in bed, raise her right arm
from her side and when the
deltoid muscles are fixed
can move the arm freely.
The muscles of the back have
improved immensely and appear
to have regained almost their
usual fulness. The muscles of
the neck are still much atrophied
and have very slightly improved.
The muscles of her upper arms
are increased in bulk, though
the left arm is still a little
the larger. The deltoid of the right
The arm has improved slightly. The left arm seems to be regaining its normal posture. The wrists have resumed their normal appearance. The left forearm is much firmer and flesher. In the hand, the thumb can now be flexed over the palm. The fingers have lost their normal claw-like appearance and can be extended and deformed. She still finds that cold causes the fingers to close on the palm. The interosseus space has become fuller and all the interossei have become firmly tightened. The thenar and hypothenar muscles are fuller; fibrillar contraction are no longer seen. The muscles of the left forearm are much fuller and in the left hand the thenar and hypothenar excursions are much improved. The enlarged metacarpal joint of the thumb has diminished & she is using more force to prevent the distraction of the thumb.
Taking place. For all ordinary purposes this extremity is quite useful.

In the right leg the cutaneous clonus and knee-jerk are not very marked. The knee-jerk on the left side is almost normal and cutaneous clonus can be produced. The patient complains that her legs still feel weak, but she is able to stand herself and do household work. In the right leg there is still a feeling of tension in the muscles of the calf.

The sensibility of the skin appears to be nearly normal. During the time of treatment, the patient accidentally hurt herself on her left arm two or three times, but was not aware of having done so, until the arm was pointed out to her, as no pain was felt. In the same way the hip could be the spinal column caused her very little inconvenience. A very weak Faradic current is now felt and the muscles generally relaxed.
Taking Mrs. B's case as a whole it may be looked upon as one where the disease had advanced to a dangerous degree, and has now apparently been arrested. There is no history of any hereditary tendency, but there is one of severe muscular extrusion in her younger child.

Miss Steele, (Mrs. B's), referring to Jeffrey in a paper published in the Arch. de Neurologie Vol. III, P. 232, 1881, states that the first para-lytic symptoms in progressive muscular atrophy are ushered in by epileptic fits at times.

Unfortunately, I cannot see any information as to the exact nature of Mrs. B's disease. The probability seems to be that there was a small hemorrhage causing aphasia. Then again: taking the history of lead poisoning, it is difficult whether this throws any light on the occurrence of the atrophy. It is conceivable that the poison acting on the nervous system...
might be the immediate cause of it. Against this theory, it is generally considered, that the invasion of paralysis due to lead poisoning is sudden and that the loss of muscular power is in excess of the atrophy. Gowers states "(Diseases of Nervous System Vol. I Part 339)" that general muscular atrophy may result from lead poisoning, but this form is not as a rule progressive in character when its cause has ceased to act. With this in mind, the atrophy and paralysis may occur concurrently; on the whole it is safer to conclude that her occupation as a nurse and cleanliness in her work were the exciting causes.

Against the view of this compression of the cord by tumors at the situation of the cervical region, these are the facts that there were increased reflexes and tendon reactions in the upper extremities. The course of this disease is essentially chronic, in time...
cases it may last for many years with intermissions of symptoms, in others it may completely destroy some parts or groups of muscles, and then become permanently arrested. Again the damaged muscles may recover their tone by heat-treatment, through Robert's steps (Magner's Sept. of med. Vol. IV. P. 340). That this is unfortunately not a very common association, we mention. "That in a case under his care, though the disease was apparently arrested, it started again with greater intensity after five years." Of an analysis of 28 cases seen by him. The mean duration was 38 months, of these 4 cases ended in recovery, 13 in permanent arrest, and 11 in death. The cases which ended in recovery had a mean duration of 14 months. Those in arrest of 24 months, and those in death of 5 years 4 upwards. Cases arising from overexertion of the muscles had a greater tendency to end in arrest while those from cold or hereditary..."
Disposition showed a more decided tendency to a progressive case and a fatal termination.

The changes found on first- and second examination are in the muscles, nerves and spinal cord. The affected muscles are found wasted in various degrees and altered in color to a pale red, and fatty tissue is found between the muscular fibers. Then there is much fatty change. The muscles waste in a less involved manner. Pearsall states (Pearsall, Dept. of Med., Vol. 7, P. 334) that this peculiarity is to be found only in the muscles of the lower extremity. Here you, Duchenne, and others regarded these changes in the muscle as being a fatty degeneration of the fibers and secondary disappearance of the sarclemma. Later investigators, Priestley, & others assert that the fatty metamorphosis of the fibers is a secondary result arising from a previous inflammatory change. (Pears Vol. 1, P. 93.)
The first change, briefly, in the perinervium internum is an increased growth of the interstitial connective tissue between the finest muscular bundles. Swelling and multiplication of the muscular epitriches, along with proliferation of their nuclei, may be observed, and at times paranchymatous granular clodiness of the neuro-epidermal plexus. (Perr. 1861) Proliferation of the muscular substance goes on side by side with increase of the interstitial tissue, a development of fluid may take place within the hyperplastic connective tissue, leading to a pseudo-hyper trophy of the muscle.

Gower states (Dea. Med. Soc. 1761) that there are four well defined changes in the fibers, first, simple narrowing of the fibers, without any considerable change in their striations; secondly, simple fatty degeneration in which the nervous striction gives place to a fatty appearance; thirdly, muscular
Jfibres are seen in which the sheath contains only a clear material enclosing a few fatty fibres and a few faint transverse striations; this is probably not the result of fatty degeneration, but has been termed fibrous degeneration; fourthly, longitudinal striation develops in the fibre, the transverse fibres ultimately become indistinct and the fibre looks like a fascicular or longitudinal connective tissue fibre.

It is very common to see unaltered muscular fibres side by side with atrophied ones.

Peripheral nerves

The peripheral nerves contain many degenerated nerve fibres and the fibre endings in the muscles contain a still larger number of them. In the latter, under the microscope, no nerve fibres may be found. The degenerated fibres come entirely from the anterior spinal nerves. Dr. Ross (Vol. I, Page 962) states that the changes observed were hyperplasia of the neurilemma, multiplication
of nuclei and fibillary thickening of the sheath of Schwann. The degree of affection of the anterior horns corresponds to the degree of wasting of the parts supplied by them.

The principal changes noted in the spinal cord are, softness of the affected portion with translucency of the white substance of the lateral columns. Necropsical changes are seen in the anterior horns and in most cases in the antero- lateral white columns. As the arms are usually affected these changes are most marked in the cervical enlargement. The cells of the anterior horns vary in the amount of degeneration from partial to complete destruction. Some are merely represented by small angular bodies, in others, a few large nerve cells are present but have lost their processes. The nerve filaments waste and there is an increase of connective tissue elements. The larger vessels are dilated.
If the legs are wasted the same changes are found in the lumbar enlargement. The gray matter between the columns may be affected, the posterior columns are always normal. The anterior cortices are nearly all replaced by fibrous tissue. In the white columns there is considerable degeneration of the anterior and lateral pyramidal tracts. The degeneration of the pyramids has been found to extend in several cases through the Pons Varolii and even through the internal capsules and even through the white substance of the cereb. The posterior columns are free from degeneration, but there may be a slight increase of connective tissue throughout the white cord.

Pathology

This form of progressive muscular atrophy has been described by Burdach as "Amyotrophische Lateralsklerose" on the assumption that the affection of the gray matter in the anterior columns was secondary to degeneration.
Of the pyramidal tracts, Gowers (Vol. I, p. 366) has shown that
these is merely giving a new
name to an old disease, as he
states that degeneration of the
pyramidal tracts is always
found in Salicic Muscular
Atrophy.
The chief varieties (Gowers, Vol. I, p. 366)
of the disease depend on the relative
distribution of three conditions
(1st) Atrophic Atrophy becoming extreme
2nd Muscular weakness with Spasm
but without wasting, or with only
slight wasting.
And (3rd) Muscular Atrophy rarely ca-
.trine in degree, with myotic
effects.
The commonest condition is 2-
there Atrophic Atrophy in the arms
and upper part of the trunk
with simple weakness and spasm
in the legs.
In the case of Mrs. B, there is present
the chief condition, with the addition
of slight wasting in the legs,
and Gowers (Vol. I, p. 376) states
that this class of case is
associated with degeneration.
Of the pyramidal fibers "and we must assume that the motor nerve cells of the cord whilst structurally intact whilst structurally intact undergo slight changes in nutrition."

As to the cause of the production of symptoms of lateral sclerosis, Dr. Gowers (1907, p. 378) says:

"Whether there are indications of lateral sclerosis or not depends on the circumstances. Whether the degeneration of the pyramidal fibers is or is not more extensive than the complete degeneration of the nerve cells that cause atonic atrophy. If the atonic atrophy be universal, the lateral tract may still be completely degenerated with no indication of a spastic condition. Gowers (loc.cit.) further states that if the arms and legs may be the seat of a spastic condition and atonic atrophy may be limited to a few muscles in the hand. Between these two conditions there may be every variation of degree and distribution of atonic atrophy."
Dystonic paralytic and tonic wasting. In the condition of tonic wasting there is considerable rigidity of the muscles with great wasting and increased irritability. It is difficult whether tonic wasting ever goes on 2-at once and vice versa, though in Mrs B's case where there was formerly loss of knee-jerk in the left leg, there is now present an increased knee-jerk & ankle clonus is easily producible with increased rigidity of the muscles of the calf. Yorvex states that in the very rare cases in which the muscles, relaxed during the process of wasting, become rigid towards the end of the process, it is probable that the rigidity is illusory, due to changes in the muscles and not in the central nervous system. It may be the result of increase in the interstitial tissue, or the longitudinal division and phyllation by which the muscular fasciculi come to resemble branches of connective.
This B's case includes almost all the ordinary symptoms of this disease, but in addition there was the presence of anaesthesia, well marked in the hands, the right hand especially, across & front of the face, together with paresthesia, sensations of coldness & numbness.

Ross referring to a paper of Landry Thessier (Vol. I, p. 952) states that in the later stages of this affection these symptoms are not uncommon.

Gowers on the other hand observes that when these symptoms are present they are due either to chronic meningitis or to disseminated focal myelitis. He at the same time mentions that feelings of numbness & deadness may be complained of, but that there is no true anaesthesia. Ross has observed, (Vol. I, p. 959), in a case there were true patches of analgesia,
A sheet of degeneration passes along the posterior branch of the central artery. This latter theory may possibly account for the condition in the 3rd case.

Another rare condition is the enlargement with pain and discoloration of the metacarpal joint of the thumb of the left hand. Remarked referred to by Ross (Vol. 1. p. 953) was described there scapular swellings; Ross considers that this condition is related to the joint affection of Jackson-Doddlis; but in that disease the authorities more often affect the large joints.

It will be as well to mention some of the other theories as to the causation of progressive muscular atrophy. Though they are only important as a matter of history, Dr. Rennells referred to by Ross (Vol. 1. p. 962) regarded the atrophy of the anterior nerve root as the essential cause of the disease. This theory as well as
That of peripheral neuritis, as a cause has been advanced. The sympathetic nerve has also been credited with the causation of this disease. It was supported by Jaccoud, but the sympathetic is by no means always affected if it is to any extent by extension from the parietal corna. Frieberich supported the theory that the changes in the nerves were secondary to muscular changes and that the disease commenced as an acute myopathy. Blanchet holds the sympathetic theory. Mess holds that the disease commences in the central grey column and extends onwards and forwards into the anterior grey horns. In the accompaniment of the development of the cord, the cells of the lateral and medio-lateral areas are absent at birth, and they are gradually developed as occasion requires, as for instance he considers that the production of the delicate movements of the hands, etc. in children is due to the development
of these areas. In this way he explains the loss of the fine movements of the hands in muscular atrophy to be due to destruction of these areas and that the affection gradually extends to the other groups of cells in the anterior columns.

Penn has followed the lead of Charnet in describing this kind of chronic muscular atrophy as Amyotrophic Lateral Sclerosis.

Complications

Chronic muscular atrophy is sometimes accompanied by symptoms of locomotor ataxia affecting the arms and legs. The most frequent complication is that of Bell's paralysis, which is simply an extension of the processes taking place in the cord into the Medulla Oblongata. In most cases resembles the acute disease, though the tongue is not much affected.

Other complications consist of severe neuralgia pains and sometimes persistent headache.
which Mrs. B. suffered... In her case the attacks of spasmatic facial tic were very severe & utterly prohibeted her for a day or two.

**Diagnosis**

The diagnosis between spasmal & idiopathic atrophy is generally easy. The important points being that in the idiopathic form it generally affects more than one member of a family & comes on before adult life is reached. When there are two conditions are not present, the diagnosis is sometimes extremely difficult. The presence of atrophy of the muscles of the face at an early period of the disease would rather point to the idiopathic form. In the spasmal form the presence of knee- jerks & atrophy of the muscles of the hands would be conclusive as in the idiopathic form the muscles of the hands are very frequently unaffected.

**Prognosis**

The prognosis in this disease is very grave on account of its progressive nature. The prospect
If early arrest of the disease is greater in those cases where the affection is symmetrical and nearly simultaneous. When the muscles of respiration are affected the danger becomes much greater as a slight attack of bronchitis may carry off the patient. If Balsam paraffin is supervene then the prognosis is much graver. Gowers (Vol. II, P. 380) states that wasting which has persisted for six months will probably persist unchanged.

In addition to what has been stated in the early part of this paper about the treatment of this 3rd stage, it will be as well to state that Gowers speaks highly of the use of the hypodermic injection of Morphine in doses from 1/60 to 1/60 of a grain. He says that it is often more effectual given in this way than when by the mouth (Gowers, Vol. II, P. 380). As regards the use of electricity he does not speak very highly, he thinks it sometimes does more harm than good; but...
massage he speaks more favorably. In the case of Mrs. B. the combination of the Faradic current with massage seems to have been very beneficial. It should be mentioned that although the disease had been present for many years Mrs. B. had only been treated by previous medical attendants for neuralgia & rhematism.