Thesis

Written on "Chronic Lead Poisoning"

by

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Chronic Lead Poisoning

Chronic Lead Poisoning has occupied the attention of writers on medical subjects since the earliest times.

Though Hippocrates is not credited with having observed the disease, the early Latin, Greek, and Arabic physicians described a form of colic and paralysis, which they ascribed to the internal use of lead, and pointed out the dangers consequent upon it. In 1656 Stockhansac, who was physician to the lead-mines at Goslar, drew attention to the subject, and his work was one of the earliest and most important contributions. Much later followed Landresel des Neuchelles, whose treatise, published in 1839, is still regarded as a standard work on the subject.

This present century has produced many investigators, and although the worst phases of the disease are not now a day so commonly met with, owing to the improvements effected in sanitary matters, some districts afford even yet a wide field for the study of lead diseases.

At Newcastle on Tyne, and in its immediate neighbourhood are several lead-factories, and, both in private practice, and in the wards of the Infirmary, striking cases of chronic lead poisoning are
occasionally seen. Most of the cases occur in connection with the manufacture of lead, and it is interesting to note here the comparative immunity from lead diseases that is enjoyed by the lead miners, who handle the ore itself, though they do not altogether escape. It may be useful to append a list of trades in which lead poisoning most commonly occurs.

I. White Lead Manufacturers. II. Red Lead Manufacturers. III. Glass-makers, (from the use of red-lead) IV. Printers and Compositors. V. Shot-manufacturers. VI. Painters, (especially those employed in mixing the colours) VII. Plumbers, VIII. Manufacturers of glazed pottery. Amongst the rest, cases occasionally occur amongst lead miners, file cutters, file-hardeners, peek-knife finishers, weavers, dyers, and workers in glass enamels.

Other and rarer cases of poisoning are frequently reported, but the above list is a fairly complete class of trades, amongst which cases most commonly occur. Interestingly, too, are the cases which occur from the use of drinking water, in which lead from the pipes or cisterns is dissolved, and this leads to the remark that lead poisoning is usually the
result of the constant introduction into the sys-
tem of very small quantities of the metal, occa-
sioning over a considerable time, rather than large
quantities, in a short time. Thus, plumbism
has been produced by so small a quantity as
0.015 per cent of lead in water which had been
regularly drunk for months, whereas from
3 to 4 grains have been taken for several weeks,
without producing any unfavourable symptom.
This abundantly proves the above theory,
and shows that in all probability the quantity
of lead absorbed into the blood at once, is only
small. Cases of poisoning have occurred
even from the medicinal use of lead, as in
Eye lotions &c. Although so much has
been done to assist the workpeople in resisting
the disease, as seen in the special sanitary
regulations in most of the lead factories, the
habits of the working classes, unfortunately,
are so careless, that they increase the liability to the
dangers to which their occupation exposes them.
The present Act of Parliament is stringent, but
it is a well-known fact, that the work people
do their utmost to evade the regulations im-
grafted on them, if they can possibly do so.
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Acid
The majority of cases occur amongst older workers between the ages of 30 and 40, but children are very susceptible to the disease. A previous attack predisposes to further attacks, even though the individual has relinquished his employment altogether. This was pointed out by Langnered ("Lead Diseases", Dana's translation) in the case of a painter who, having suffered from lead poisoning, took to some healthier employment, and nevertheless suffered from attacks of colic for several years afterwards.

**Mode of introduction of lead into the system.** Lead is introduced into the system through the alimentary canal, the respiratory tract, and through the skin. The most common mode of introduction is by the stomach, by the contamination of articles of food and drink, and this is evident in persons not employed in lead working, as well as in those who earn their living by it.

Amongst the latter class, it is by no means uncommon to find them taking their meals in the workshop, where the air is contaminated, and eating their food with unwashed hands.

In the former class, cases are sometimes met-
with persons who show symptoms of lead poisoning, and we find the cause in the water which they have been accustomed to drink.

Soft waters are liable to become charged with lead, in the case of rain waters, from the formation, and subsequent solution, of oxides, on account of the excess of oxygen present; in the case of surface waters, from the presence of annirial organic matter containing nitrates and chlorides, which form soluble salts with lead.

Hard waters, as is well known, are not so liable to contamination, though the protection afforded by the insoluble coating of sulphate, or carbonate of lead, which forms on the leaden pipes or cisterns containing the water.

Other methods of introduction to the stomach are found in articles of diet, which have been stored in vessels containing lead in some form, for example, cheese wrapped in lead foil, born through lead pipes, and cider stored in leaden vats.

The Respiratory Tract:—The question of the ventilation of workshops, where lead salts in a dry state are handled, is important, as bearing on this point. Undoubtedly the greater number
of cases arise from the dust being drawn into the upper part of the respiratory tract and then swallowed. As a means of precaution, lead workers in this district are accustomed to make use of respirators.

By the Skin:—Tanguerel (op. cit.) does not admit that the absorption of lead can occur without breach of surface, and experiments performed on animals support his opinion. On the other hand, cases have been reported of poisoning from the use of cosmetics, though this might be explained by idiosyncracy.

If, however, lead is applied to a breach of surface, plumbeus may be produced.

To sum up, then, these methods of introduction, it is probable that the alimentary and respiratory tracts are the most frequent channels, and, as has been pointed out, they are closely allied in the absorption, and it is more than likely that the skin only plays a secondary part.
Symptomatology.

The symptomatology may be conveniently divided into two great groups, viz. (1) The disturbances of nutrition, and (2) The specific symptoms, which include colic, antralgia, and a series of cerebral phenomena, designated the encephalopathy.

The symptoms of chronic lead poisoning are varied, not only in the order of their appearance, but also in their duration and degree, and, as has been previously noted, much depends on individual susceptibility, and on the precautions adopted.

Disturbances of Nutrition. Generally speaking, the disease is ushered in with symptoms of general ill health, with some loss of flesh, and a feeling of weakness. The patient becomes sallow and cachectic, his expression often changing to a dull listless appearance. The complexion assumes an earthy, yellowish tinge, to which Sanguier applied the term *Icterus Saturninus*, which, if understood by the use of word now a day, would be misleading, as there is no real jaundice, and the so-called jaundice is not due to the bile pigments.
Icterus Saturninus may not improbably be due, partly to the constipation, and partly to the anemia. In the former, there is allowed excess reabsorption of bile, and through the latter, a lessening of the normal transformation of reabsorbed bile in the blood.

Amongst other symptoms at this stage may be mentioned, celiacal pain, constipation, nausea, sometimes vomiting, sleeplessness, a bitterish astrinvent taste in the mouth, with fetid breath and coated tongue, wandering pains in the limbs, and another, which I have often noted, viz., epistaxis. In certain cases, notably tile cutting, a peculiar form of acne often makes its appearance. Headache is also an early symptom, and a most distressing one. In women especially, there may be seen a characteristic fulness of the cheeks, which, taken with the peculiar anemic appearance, often leads an observer to pick out cases of lead poisoning amongst the passengers on the streets, or in the waiting-rooms of Dispensary or Hopsital. Tremulousness of the lips, due to muscular twitchings, are often observed in these cases, and is so constant—
that it may resemble paralysis agitans.

These symptoms are referred to later as an early symptom of lead palsy.

Along with these early symptoms, in most cases, we have the characteristic discoloration of the gums, known as the Blue Line, most strongly marked in persons who neglect their teeth. But this symptom must not be taken, per se, as evidence of lead poisoning, as it is present in many cases where no other sign of plumbism is discernible. The discoloration, as is well-known, is due to the deposit of Sulphide of Lead upon and in the substance of the gums, at their junction with the teeth. Stenmon proves conclusively that the blue line consists of particles of lead, but that it does not depend solely on the mechanical application of lead particles in the gums, as shown by the fact that after the complete disappearance of the blue line, it has been known to return under the influence of Solutions of Potassium, without any past exposure to lead impregnation. Dr. Jafger, in his researches on the formation of the blue line, concludes that the Sulphuretted Hydrogen
generated by decomposing food between the teeth must find its way into the substance of the gums, and combine with the lead to form the sulphide, and therefore the pigment is to be regarded as a precipitate from the blood. The blue line is most commonly observed on the front teeth and adjacent gums, but the discoloration may involve the whole surface of the cavity of the mouth.

Beyond this stage, the disease often makes no further progress, but usually some of the symptoms, before spoken of as specific, make their appearance, amongst which one of the commonest is Colic, and next in order of frequency, come the joint affections, the paralysis, and the encephalopathy.

Sanguineal states with regard to the relative frequency of these four symptoms, that in every 14 cases, Colic shows itself in at least 12, anthralgya in 8, paralysis in 2, and cerebral phenomena in 1.
Colic. Colic then, according to Bauquier, is one of the earliest symptoms of chronic lead poisoning, but it may be preceded by any one of the others, or it may be absent altogether.

Lead colic has certain prodromata, nausea or vomiting, constipation, eructations, borborygm, and a sense of weight in the epigastrium.

Occasionally there is diarrhoea, but the opposite condition is more frequently noted, but there is often great tenesmus. The colic may originate suddenly, and is often characterised by exacerbations and remissions. In some cases, the pain is very violent, and is usually referred to the umbilicus, and there is generally hardness and retraction of the abdominal walls. During an attack of colic, the pulse becomes irregular, and there is frequently a peculiar slowness of the beat, even falling to 30 or 40 per minute.

The duration of the attack is seldom longer than a week, but relapses are frequent, and even though the sufferer be altogether removed from the sources of infection, he may suffer from this symptom for years.
Arthralgia, according to Jaugy, comes next in order of frequency amongst the symptoms of lead poisoning. It is difficult to satisfy oneself that the wandering pains in muscles and joints are really due to lead poisoning, indeed there is often reason to believe that they may be placed in the category of simple rheumatic affections. A great similarity between the Arthralgia and the Colic has been observed.

Most frequently there is numbness in the parts, and then, more or less suddenly, severe cramps appear in the joints, and muscles and covering them, accompanied by contractions of the latter, the pain being described as of a "burning, tearing" character. These pains are relieved by pressure, and are quite unwarranted by any appearance of inflammatory action in the parts attacked.

The pains appear especially to affect the lower limbs, and particularly the knee, less frequently they involve the upper extremities, the trunk, and thorax.
Paralysis: In Tanguereau's observations, paralysis only occurred in 2 out of 12 cases, but other writers have placed the percentage of this symptom as high as 25. Tanguereau states that paralysis has been known to occur as early as the third day after the first exposure to lead, and mentions that out of a series of cases, 9 occurred during the first month, 14 in the course of the first two months, 36 in the course of the first two years, 32 after ten years, and 8 after twenty years.

In one case, a man had been a worker in lead for fifty-two years, and had never suffered in his health until the paralysis appeared at the end of that time.

As a general rule, paralysis is preceded either by Colic or Arthralgia, sometimes by both. Lead Palsy has certain prodromata, its onset is very gradual, and one of the commonest precursors of an attack is a feeling of numbness in the head, sometimes then comes hyperesthesia, and frequently the patient complains of his limbs feeling heavy and tired.

Other early symptoms are a peculiar tremor of the arms or legs, or both, and pain in the muscles themselves. These tremors
frequently commence in the arm and extend to the leg, they are not as a rule accompanied with pain, and, when occurring in the arm, it has been observed that they cease on forcible extension of the thumb. Tauschker states that these tremors chiefly occur at the onset and at the time of disappearance of the paralysis. Lead paralytic, as Nightingale (in Leesmere Cyclopaedia) observes, "shows an almost freakish opposition" regarding localization to Arthralgia. The latter shows a preference for the lower limbs and the flexors. Paralysis attacks the upper limbs and the extensors. Paralysis attacks the muscles of the upper extremity in a certain regular manner.

According to Duhamel, the extensor communis digitorum and the extensors of the first and little fingers suffer most commonly. Met the extensor secundus internodi pollicis, and 4. extensor carpi radialis brevis, whilst less frequently, the extensors carpi radialis longiss, carpi ulnaris, extensor carpi volaris, and proximuli internodii pollicis, are affected.

The muscles attacked most frequently are those supplied by the musculo-spiral nerve,
and its distribution, especially the posterior ulnar sensory branch, but although the supinator longus and \( \& \) flexor carpi radialis are both supplied by the musculo-spiral nerve, the power of supination and pronation is as a rule unimpaired. The triceps and deltoid are less frequently attacked, and still more rarely the muscles of the lower extremity, the dorsal and intercostal muscles, and those of the larynx and face. It is generally thought that paresthesia is, as a rule, unaffected in head palsy; and Jangueul states that he only met with anesthesiæa in eleven cases out of a total of thirteen hundred examined, and this opinion would appear to be shared by Næguy (op. cit.) who states that "usually there is anesthesiæa of the skin only, rarely of the skin and deeper tissues. It has no definite relation to the muscular paralysis, it may appear with paralysis, and also with Colic and Arthralgia. There may be both Arthralgia and anesthesiæa of the skin in the same locality. On the whole, in local anesthesia, and in its course, it is very varying, and, as it were, freakish. The attack in one place
disappears today only to appear in another in a few days .......... It rarely lasts longer than fourteen days." Now, although it may appear somewhat startling, I must state that I have seldom examined a case of plumbeous without finding some degree of anesthesia, so that, whilst agreeing with Stannus that in all probability the anesthesia has no definite relation to muscular paralysis, I must consider his views as to the extent and degree of persistency of the sensory impairment, open to doubt. Often however, occurring in young women, the possibility of its sometimes being of a hysterical nature must not be lost sight of.

I have before mentioned that hyperesthesia is often a precursor of paralysis.

With regard to the atrophy associated with lead paralysis, it is interesting to compare it with the wasting of progressive muscular atrophy.

The atrophy of lead paralysis is rapid, at all events more rapid than in the other disease, and the unaffected muscles throw into prominence, in lead paralysis, the wasted condition of the affected ones. It is worthy
of remark in this instance however, that lead poisoning has been regarded as a probable factor in the production of Progressive Muscular Atrophy.

Dr. Forrier in a paper read some years ago before the Harveian Society, refers to certain tendinous swellings which form on the back of the wrist. Of these so-called tubercles or nodes there was as yet no satisfactory explanation, and in this neighbourhood, they are as uncommon and as little met with, as the spot so often associated in some localities with the lead dyscrasia. The tendinous swellings indeed, have been attributed to a gouty constitution, but they are met with in cases where there is no symptom of the gouty constitution. Two explanations suggest themselves to me, the first that they are due to partial dislocations, due to the conflict, if one may so call it, between the paralyzed extensors, and the uncounteracted flexors; and the second, that they are due to the constant stretching of the tendons in their sheaths, the result being inflammatory exudations in the latter.

In certain trades, in
Cases of lead palsy, one finds one arm more affected than the other, and this is generally explained by the more frequent use of the affected arm, or its contiguity to the source of infection.

Returning again to the distribution of lead palsy, we find that it may be limited to the extensor of a single finger, or with gradual invasion, it may affect most of the muscles of a limb, or even the whole body. Sometimes it resembles hemiplegia, but more generally it affects both sides, and frequently attacks corresponding muscles. In the affected muscles, there is diminution or entire loss of reaction to the induced current, and this may be regarded as a characteristic feature of the disease. Lead paralysis is usually progressive, but sometimes it only amounts to a slight loss of power, and remains so for years, or disappears spontaneously, or under treatment. In many cases where atrophy of the muscles has been long established, permanent disablement occurs, and the progress in all cases must depend on the proportion of lead cachexia present. A typical case of lead paralysis will be found in the Appendix.
Encephalopathy, is the somewhat-cumbrous
word used to designate the cerebral phenomena induced
by the influence of lead on the cerebral. With regard
to statistics the relative frequency of its occurrence,
the statistics of Tanguerel, who observes that the
cerebral phenomena manifest themselves only once
in fourteen cases, is not confirmed by the experience
of practitioners in this neighbourhood. I have
on several occasions been summoned to cases
of convulsions which I have proved to be due to
lead poisoning. The premonitory symptoms
in such cases are depression of spirits, severe
headache, vertigo, loss of memory, and gradual
unconsciousness. These epileptiform convulsions
are the most frequent manifestation of the cere-
bral phenomena. Tanguerel divides Lead
Encephalopathy into four forms, viz:—the
lead insanity, the convulsions, the coma, and
a form which combines these three conditions.

The attacks of Epilepsia Patalunina have
sometimes the prodromata above alluded to,
but, at other times, their onset is sudden.
There is never the aura of true Epilepsy, and
the attack is seldom limited to a single "fit";
more generally each convolution is more severe.
than the preceding one, and there is but a short period of unconsciousness, until the fits recur with such severity that the sufferer relapses into a state of coma, where death may occur, or if the disease take a favourable turn, the convulsions become less frequent, and consciousness gradually returns, though relapses are by no means infrequent. The urine, if examined in these cases, is usually free from albumen, indeed the majority of my cases have been those of young and otherwise healthy women, who have only worked amongst white lead for a month or two, thus showing the non-connection with uremic poisoning, which is a frequent factor in the production of convulsions in the later stages of lead poisoning. Thus we can only ascribe them to the specific action of lead in the brain, and though lead has been found in that organ, the pathology of this affection is not yet thoroughly understood. Inquieti delirium describes two varieties of the delirious form of lead—encephalopathy, the tranquil, and the furious. One feature common to both forms of this delirium, is the extraordinary changableness...
of the mental attitude of the sufferer was clearly demonstrated in a patient in the Newcastle Infirmary in 1885, who could be suddenly aroused, and taught to understand his surroundings, and to answer questions sensibly, when he gradually relapsed into his former wandering mental state. Vaquerel states that of 72 cases in which cerebral symptoms developed, 16 only proved fatal. I think his statistics on this point are too low; in this neighbourhood coroners' inquests are frequently held, where the verdict is returned "Death from Convulsions due to Lead Poisoning".

In conclusion, it may be pointed out that there is in this branch of the subject, a certain affinity or likeness to Chronic Alcoholicism.

In both cases after the prolonged influence of the special poison, there may result a condition of feeble-minded intellect, amounting sometimes to positive insanity.

Lead Amaurosis. An important symptom which shows itself sometimes at the commencement, at other times at a late stage in poisoning by lead is Amaurosis or Amaurosis. Vaquerel did not lay much stress
On this assumption, but probably little was known of it at the time; he ascribed it to anaesthesia of the retina. It is now considered certain that lead acts directly upon the disc and retina, and causes distinct pathological changes in both. It is hardly questionable that although there may be a distinct lead neuro-retinitis, that there may not co-exist an albuminuric form. Cases are met with where one finds optic neuritis present, and yet no albuminuria, and this supports my opinion that the lesions met with in the eye in lead poisoning, are not invariably, as has been stated, secondary to kidney disease.

The following is a case recently under my care, illustrative of lead Arachnitis.

Mr. W., aged 26, has worked in white lead for seven years, during which time she has had three distinct attacks of lead poisoning consisting chiefly of colic and arthralgia. The eyes have not previously been affected, and the affection commenced a fortnight ago with severe headache, and a heavy feeling about the temples. A day or so before I saw her, she had a convulsive seizure.
and thereafter became quite blind. Patient appears to be a girl of strong constitution, but anaemic looking, the cheeks are puffy, and the expression listless. The teeth are very much decayed, and the blue line is well developed. She suffers from Arteriothrombosis. There is external deviation of the left eye, which she states was not present before her present attack, and the pupils are slightly dilated. Ophthalmoscopic examination, by the indirect method, showed the following condition, of which I have attempted to make a drawing.

Well marked double optic neuritis, the discs are much swollen, and at their margins distinct striae radiate outwards. The veins are enlarged, and there are dense vessels issuing from them. These disappear entirely in the effusion, very few of them can be traced to the centre. The arteries are small. The fundus surrounding the disc appears to be congested, and is of a brilliant red colour. In places, small patches of lymph, lightening up well, give the appearance as though the fundus had been besmeared with white paint, especially at the apparent upper border of the left disc. There are no hemorrhages.
In this case there was no albuminuria. The knee jerk in the right leg was very feeble, almost absent; in the left leg it was feeble. There was no ankle clonus, nor plantar reflex.

The onset of the transient form of lead amблиopia is generally rapid, and it may disappear as suddenly, leaving no discoverable structural changes behind it, but in the true form there is usually atrophy of the disc, with progressive blindness.

Two diseases are often described in connection with chronic lead poisoning, viz. Gout, and Interstitial Nephritis. The former is rarely seen in this neighbourhood, in fact I cannot recollect ever seeing a case. Albuminuria on the other hand, is a common symptom, in some cases it is only transient, more generally it is evidence of serious mischief in the kidneys, and in cases where Gout is present, the latter disease may be the actual cause of the nephritis. At other times, it is probable that the lead acts directly upon the renal cells, which producing a low form of irritation, which
eventually ends in fatty degeneration and atrophy. Lead prevents the excretion of urine acid by the kidneys and thus predisposes to gout. Gout is apt to be followed by Carcinosis of the kidney, and thus lead indirectly causes this condition in the kidney. In these cases albumen is often absent from the urine, and it is thus probable that many cases dying after convulsive seizures, and recorded as due to lead poisoning, are only remotely due to, the most likely cause being kidney disease. Statistics of deaths from kidney disease in chronic lead poisoning show a high rate of mortality, one worker has recorded 26 deaths out of 42 cases.

I might here append a drawing of a section of granular kidney from a case of lead poisoning in which that organ was found to be "full" of lead.

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I. Shown the thickened capsule of star-shaped bodies, bunches of tiny blood-vessels, compressed urinary tubes; masses of embroyonic connective tissue passing from the cortex between the bodies.
Theories concerning Lead Poisoning, Pathology 9c.

As yet only little is known concerning the action of lead on the system. The theory that lead acted directly on muscular fibre, more particularly striated, has been exploded by the researches of Heubel, (Pathologie und Symptome der Chronischen Bleivergiftung) who showed that at any time the total amount of lead in the system was very small, and especially in muscular tissue. It was a feasible argument, for one could then easily explain the colic, the arthralgia, the peculiar pulse, the anaemia, and the abortion of pregnant women eating unlead. But this theory is well known entombed. Lead colic is probably due to the specific action of lead on the intestinal muscle.

The arthralgia have been ascribed to toxic muscular contractions, but I lean to the opinion that they are due to an irritative lesion of the nerve fibres in the muscles themselves, and in this connection may be said to be analogous to alcoholic pains. As regards the lead palsy, Kanyee states that it is most probably a disease of the nervous system, and not primarily one of the muscles, in opposition to the theory of Suschrow, (Archiv. f. Path. Anat.) who,
because he found lead in the muscles, came to the conclusion that it was primarily one of the muscular tissue. Henbel has shown that the brain and cord in cases of lead poisoning exhibit at least twice as much of the metal as the muscles. Thus there is, so far as our present knowledge extends, every reason for supposing that it is a disease of the nervous, and not primarily one of the muscular system, but whether it is of central or peripheral origin is not so readily decided. Remak considers the disease of central (spinal) origin, but Dr. Ferrer considers lead paralysis as due to a peripheral neuritis, and in support of this urges that owing to the connection between the nuclei of the 4th centers, and those of other muscles in the anterior cornua, a localized lesion of this part of the cord, should implicate groups of muscles other than those usually affected in lead paralysis.

In the majority of cases at least, the paralysis ("drop-wrist," for example) is due to inflammation of the nerve trunks, (neuritis). This has now been shown to exist in a considerable number of cases, at the
Some times it cannot be denied that in some cases of paralysis and atrophy in lead poisoning, the ganglionic cells in the anterior grey horns of the spinal cord are affected.

But even here the question has been raised whether this latter lesion is of primary origin, or else is secondary to disturbance in the nerve trunks.

Lead, as has been mentioned, has been found in the brain; I have also found it in the muscles and kidney. Paralyzed muscles show fatty degeneration and atrophy, the naked eye appearing of a pale yellowish colour. As a proof of that the presence of lead in the muscles is not the actual cause of their degeneration, one finds the metal equally abroad in the healthy muscles lying adjacent.
Having thus surveyed the history, symptomatology, and theories of lead poisoning, I propose in conclusion to glance briefly at the treatment of lead diseases.

Prophylaxis must necessarily, in such a disease, have great importance. The greatest care should be taken to secure the perfect ventilation of workshops and occupant cleanliness. Even the minutest details must be imposed on the workers in our lead factories, as well as on those whose occupation exposes them to impregnation by lead.

In most of our lead factories, attention is paid to the well-being of the workpeople, baths being fitted up for their use, and respirators ordered to be worn in certain of the departments where processes are carried on in a dangerous dusty atmosphere.

Into an often employed carrying baskets of which lead on the head, each workers should always wear the close-fitting cap designed to prevent the dust lodging in the hair. If the workpeople dine at the works, as is not infrequently the case, overcookers should see that proper ablutions are carried out, and that the outer clothes at least are changed.

There is no antidote to the poison, but common salt has been recommended as causing the
Elimination of lead by the kidneys as a chloride.
Reports may also be made to the use of acidulated drinks,
such as lemonade and Sulphuric Acid. In factories,
the periodic inspection of the workers by a medical
man is of great importance, and any persons showing
delicacy of constitution, or the slightest symptom
of lead poisoning, should be immediately sus-
pended from work. Those also who work in
the most dangerous processes, should at times
be placed in the less harmful department of
the factory. Finally, as lead poisoning has
undoubtedly given rise to abortion in pregnant
women, the latter should be always excluded
from such employment.

With regard to the medicinal treatment of
the various lead diseases, little need be said.
Opium is frequently called for in the treatment
of Colic, and, along with it, hot fomentations and
baths, followed by mild cathartics. I have found
Croton oil as recommended by Tanguerel, useful
in some cases of obstinate Constipation.
The Articulargia are best treated with warm baths
and the administration of Sodite of Masseuill. In Paralysis,
Sodite of Masseuill with Sulphate of Magnesia
seems to act best, combined with the use of the
Slowly interrupted current—in the earlier, and of the Paralytic in the later stages, along with which massage may be employed with very good results. Strychnine also, as recommended by Tanquerel, has been of use in some cases.

The Cerebral Symptoms must be treated especially, no good results having been arrived at by any definite line of treatment.
Appendix

I here give a case illustrative of Lead Paralysis.

D.B., aged 31, Single, a labourer at the lead works, came under my care on May 6, 1886, complaining of dropped wrist and numbness in the arms of about a month's duration.

There is nothing of interest in his family history. Patient states that he has always had a comfortable home, and good food. He has been accustomed to take a glass of beer, but has never been intemperate. No history of Syphilis, nor of any ailment since childhood, except lead poisoning.

He has had four distinct attacks of lead poisoning. The first after he had worked in lead for three years, the second a year later, the third two years after, the second attack, and the fourth a year ago. The first three attacks were of the nature of lead colic; in the fourth the bowels and arms were affected, the latter being only "numbed."

At the time of his first attack, he was working in a red-lead furnace at Elsmere, the lead being dry but dusty. In the second, third, and fourth attacks, he was employed in the whole lead processes, but was only occasionally exposed to the dust from the drying machine.
The present illness is the fifth attack, and is more severe than any of the preceding ones.

**History of Present Illness.** After being under treatment for the fourth attack for a fortnight, he went back to work at the white lead works, and remained there for five or six months. He was engaged at this time in the washing department, and had to drain away the water from large tanks, after the lead had gravitated to the bottom, his hands were thus constantly in water.

About five weeks ago, he noticed when at work that his hands became cold, and that he had considerable difficulty in taking hold of anything. The following day, he lost the use of the third and fourth fingers of the right hand.

He continued to work in this condition for a few days, but his hands ultimately became so powerless, as to compel him to stop work.

He ceased work on Tuesday, and on the following Saturday morning he noticed when he awoke that both wrists had dropped, and become perfectly useless. The dropping of the left wrist was not preceded by weakness in the third and fourth fingers as in the right.

At this time also, he had a severe itching
sparing pain over the left hypochondriac region, which at times pierced down towards the groin. He was also subject to sickness and constipation. He received medical treatment for a week or two, and was somewhat benefitted, but his wrists remained as before.

Present condition. The patient presents a hollow, and somewhat emaciated appearance. The conjunctiva and lips are pale. His fingers, particularly at the knuckles, have a peculiar hard appearance. Skin is dry and harsh.

Temperature normal. Pulse 50 per minute.

The abdomen is not now scroffen, nor painful.

The extensors at the back of both arms are paralyzed, and he has consequently the dropped wrist. The extensor longus remains active. He still has power over the flexors, but the contractions of those muscles are somewhat impaired. He has difficulty in grasping anything, or in clenching the fist. The small muscles of the left hand remain active. On the back of both hands, there is a slight swelling, circumscribed, a ganglion, more marked on the left than on the right. Both arms are somewhat atrophied. The extensors do not at present.
respond to the interrupted current. Cutaneous sensibility impaired.

Digestive System: Tongue furred, occasional thirst complained of. Appetite good. Stools somewhat swollen and congested. There is a distinct blue line between the gums and the teeth. No pain after eating. Bowels usually constipated.


Circulatory and Respiratory Systems normal.

Patient was placed on the usual diet and treatment, and his progress is thus reported.

May 14: Head puffy and oedematous, pit on pressure. There is an area of anaesthesia on dorsal side of both arms, more marked at radial border. Also on the back of the hand.

May 26: Patient has had the interrupted current for a fortnight, and today, for the first time, the extensor muscles act faintly to the stimulus. The flexors act well. There is an area of hyperaesthesia in the region of the head of the elbow in both arms. The anaesthesia noticed on the 14th does not correspond to the
distribution of the muscular-sensory nerves.
The lower eye lids are puffy and oedematous, as also are the backs of both hands. There is no albumen in the urine.

May 25: The physiatrics still act faintly to the interrupted current, but the patient has no voluntary power over them. There is considerable puffiness of the eye lids and back of both hands, the latter put on pressure, and cause stinging pains when pressed. No albumen.

Patient had spring-splint applied to back of left arm and hand.

June 6: Patient can faintly feel the wrists voluntarily. Puffiness of eye lids and backs of hands has disappeared. Splint removed.

July 12: Is now much improved, but continues to attend daily to have battery applied to arms.