AN ANALYTICAL AND CLINICAL EXAMINATION
OF
LEAD-POISONING IN ITS ACUTE
MANIFESTATIONS.

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NEWCASTLE-UPON-TYNE and the surrounding district have been for long the home of the lead trade. At the present time the amount of lead and silver ore raised in the counties of Northumberland, Durham, and Cumberland is considerably less than formerly, but this is counter-balanced by the very large imports into the Tyne of a richer lead ore from Spain, and thus it is that there is greater activity in the lead industries to-day than there ever has been. As an illustration, in the year 1862 the amount of white-lead alone manufactured was 7500 tons, and in 1887 it was 14,000 tons.

Of all the industries on Tyneside, lead-making is the one which has unfortunately gained for itself a bad name. Lead workers are not as a rule a healthy class of people. Too soon, in spite of precautions which, it must

be admitted, are not always attended to by the workpeople, many of those who are engaged in the process become indisposed. It is the workers amongst *white-lead* rather than *red-lead* that suffer the more frequently and severely, although the lead-smelter and separator of the ore may suffer. No local industry sends to the Newcastle Infirmary such human wrecks as lead-works do. On looking over our Infirmary Registers for the last five years I find that 135 cases of lead-poisoning were admitted as in-patients. Of these, ninety-one were women, and forty-four were men; eight died, three men and five women. Most of the women were young, and died soon after being exposed to the influence of lead. The eight deaths reported do not represent the total number of deaths from the effects of lead-poisoning, but only those who died from the immediate or primary effects of lead.

The danger to the individual from the inhalation of lead begins with the process of smelting. The lead miner never suffers. Animals that graze in the neighbourhood where lead-smelting is carried on suffer from colic and other symptoms of lead-poisoning. In Weardale this fact has long been known to the farmers who from time to time have received compensation for the injury thus inflicted upon their cattle. Within the last few years a hood has been placed in front of the furnace in the lead-mills, and since then smelters have not suffered. I have known smelters suffer most severely from the effects of lead-poisoning. In one case, to my knowledge, four sons in one family, all stalwart men, died from the effects of lead-poisoning through the development of kidney disease—a circumstance which, supported by other experience, makes me believe in the existence of not only an individual, but a family predisposition to plumbism.

The worst effects of lead are met with amongst the *white-lead* workers. Women and girls suffer not only much more severely, but much earlier from the effects of lead than men. In a few days in some instances, or at the most after a few weeks' exposure to lead, either in

what is known as the "white beds" or the stoves, there is produced an anæmia which goes on rapidly increasing. Colic and headache are complained of, and occasionally vomiting and disturbances of sight, amongst which I would mention double vision and amaurosis.

The excellent system which prevails at our lead-works of a weekly inspection of the workers by medical men is one of the best preventives of lead-impregnation that I know of. The slightest indication of lead-contamination noticed by the medical examiner is made the occasion of a recommendation to the employers for a three months' suspension from labour on the part of the lead-workers. Knowledge of this fact, however, not only causes the workpeople not to complain when inspected by the doctor, but to insist upon feeling quite well, although an hour or two after the inspection they may be found suffering from colic and unable to follow their occupation. The high wages tempt them to deceive not only the doctor, but also the employer. Lists of the workpeople who are suspended on account of illness are circulated amongst the lead manufacturers of the district. A woman suspended at one place, having as she thinks recovered her health and unwilling to be idle for three months, applies at another factory in the district for employment, using a false name. It is only by the most careful discrimination on the part of the manager and examination on the part of the doctor that this rule is not more widely broken. It was on looking over the lists in the factories of workpeople who have been suspended, when I have so very frequently seen the names of girls who were sisters or cousins to each other, all of whom had suffered from lead-poisoning, that I have been led to believe in the existence of a family predisposition to plumbism.

In spite of all the precautions possible that are taken by the employers to prevent contamination of the workpeople, the fact remains that every now and then a girl of from eighteen to twenty-three years of age works only a few weeks or months in a lead factory when symptoms of

acute lead-poisoning are noticed, namely, colic, constipation, vomiting, headache, pains in the limbs, and incomplete blindness. In a few days, with or without treatment, she becomes convulsed, and dies in a state of coma, the death being so sudden that we cannot but regard it as due to an acute toxæmia, and in some way or other dependent upon the influence of lead. In most of these cases albuminuria is absent, and at the post-mortem no organic change is found save a hydræmic and anæmic condition of the brain; and on chemical analysis, as shown in the charts, lead is found in the various organs, *e. g.* the brain, liver, and kidneys.

It is not so much my wish to give in detail the physical signs and symptoms of lead-poisoning as to draw attention to some peculiarities connected with them, and above all to the pathology of the acute cases.

The presence of a blue line on the gums is a physical sign of very great importance when present. In some of my cases, however, it has been absent, and yet the patients have suffered not only from colic, but from symptoms of lead encephalopathy. In a paper published in the 'Brit. Med. Journal' for October, 1885, I stated that I had found a blue line present in 13 out of 18 cases—or in 72 per cent. A few weeks ago I visited one of the lead factories in my neighbourhood, and examined 38 women of all ages from eighteen to seventy-two, taken at random and engaged in various departments, and I found a blue line present in 28 out of these 38, or in other words 73 per cent. As these two numbers almost tally, I take it that this is about the usual percentage. It is a sign not always to be relied upon; as we have seen, it may be absent, when other symptoms of poisoning are present. I have seen the blue line well marked in girls who have worked only one week in the factory. Here, however, we must be careful to distinguish between a blue line due to the deposition of sulphide of lead in the gum and the discoloration which occurs by the simple deposit of lead dust on the surface of the gum seen in girls who have been only a day or two in

the factory. The latter easily disappears after washing and cleansing the mouth. That the blue line is due to the action of sulphuretted hydrogen upon lead circulating in the blood is confirmed by a circumstance such as this, that in one of my patients—not a lead-worker—two drachms of acetate of lead were taken with suicidal intent, and on the following day a distinct blue line had developed in the gum, which persisted for several days. Dr. Inglis, of Jarrow, has found in many old lead-workers, in addition to the blue line, dark discoloured patches inside the lip opposite ragged canine teeth; these patches are as a rule irregular in shape, and seem to depend upon blocking of the follicular glands by particles of lead. In one of his cases presenting this sign the woman has worked almost continuously for seven years without suffering. The same observer also tells me that he has frequently met with dark blue lines and stains in the middle portion of the small intestine, and with large patches of staining in the large intestine. The presence of these patches is with difficulty explained, unless it be that they are dependent upon hardened pieces of fæcal matter strongly impregnated with lead having lain for a considerable time there, so as to allow of absorption taking place. The stain, it is to be remembered, is beneath the mucous membrane.

Of such signs as wrist-drop and paralysis I shall say nothing, save that the paralysis occasionally extends to muscles of the arm other than those supplied by the musculo-spiral nerve: these all undergo atrophy. I have seen the peroneal muscles affected.

Nor of colic shall I say anything except that it is a most common symptom, frequently obliging the lead-worker to desist from his or her occupation whilst no other indication of poisoning is present. It is difficult to explain this colic. The metal is undoubtedly present in the tissues, but, as will be seen on referring to the table which deals with the amounts of lead found in the various tissues after death, the quantity found in the intestine is small. I have never found the wall of the intestine thickened, as

some writers maintain ; nor will a general ischæmia explain the colic, though a partial ischæmia may. The pain is dependent upon muscular spasm of the intestinal wall.¹ Knowing the tendency of the nervous system to become rapidly affected by lead, and some parts more quickly and profoundly than others, it is just possible that the abdominal sympathetic ganglia are variably affected ; some more than others, and some, perhaps, not at all. The result, then, would be incomplete paralysis of some segments of the intestine and over-action of others.

People who have been long exposed to the influence of lead suffer as time goes on from renal disease—followed, it may be, by disease of the heart ; and death comes either from albuminuria being followed by exhaustion and allowing of the development of some intercurrent affection, or from uræmia or cerebral hæmorrhage.

But I would call attention especially to certain cases of acute lead-poisoning. For example, a girl works, it may be, only a few weeks or months in a lead factory, when, after having been noticed by her friends to have been rapidly becoming anæmic, she complains of colic, constipation, headache, dimness of vision, and in a few days afterwards develops convulsions, or becomes delirious and dies comatose. As the symptoms are so rapidly developed, and as no organic change is found post mortem, the death can only be attributed to toxæmia. Death in these cases is analogous to death from strychnine-poisoning. From the hydræmic condition of the brain found after death, the inference is that there has been irritation of the vaso-motor centre, and spasm of the cerebral arteries ; and that these conditions are caused either by the lead itself acting as a poison to the nervous system,

¹ To this extent I follow Harnack, who also states that the colic is due to irritation of the intestinal ganglia. In man, he says, the result of this irritation is a spasmodic contraction of the intestine producing constipation ; whilst in animals, we are told, the same cause produces increased peristalsis and diarrhœa. I find in this an explanation of the increased general arterial tension which may be present, but not of the colic which is always more or less localised.

or by the poisoning of the blood from retention and circulation of effete material due to lead interfering with the function of the emunctories.

When we come to analyse the symptoms in these cases, what we find is that in them as in the less acute cases, and my remarks now will apply to both, there have been colic, vomiting, headache, and constipation, and that for some time past the patient has been very anæmic. There is no doubt about the anæmia, or saturnine cachexia, as it is called : hæmocyto-metric observations show a very marked disappearance of red, and a slight increase of white, blood-corpuscles. What the anæmia is due to is another thing,—one, too, very difficult to explain. All the women engaged in this industry suffer sooner or later from disordered menstruation : young girls at first from excessive menstruation, and married women also from menorrhagia ; these exhibit a marked tendency to abort if pregnant ; others suffer from amenorrhœa. In exactly one half of the women questioned at the factory, between the ages of eighteen and forty-five, the menses were excessive ; in one menstruation had been for years suppressed ; in the rest it was regular. We may therefore find a partial explanation of the anæmia in this excessive menstruation, which I certainly regard as one of the peculiar and pernicious influences of lead upon women ; and it is just possible that in this disordered and excessive menstruation lies the secret of women suffering more than men from lead-poisoning. But one half of the women have regular menstruation, and are yet anæmic : men, too, suffer from this cachexia. We are therefore obliged to admit that lead exercises a very prejudicial effect upon the blood itself or upon the blood-making organs.

Accompanying the headache is dimness of vision. Two or three of my patients had diplopia. In these cases where vision is obscured the most marked optic neuritis is found, and this at a time when, as no albumen is present in the urine, the change in structure must be due to some peculiar influence of lead upon nerve. The signs are those

of ordinary optic neuritis. This is very quickly followed by atrophy in some instances, and permanent blindness may be left: in many, on the other hand, the optic neuritis quite clears away. In all, however, it is an indication of the severity of the lesion and a measure of the danger. Later on, when albuminuria has been developed, there have been superadded to the physical signs of lead neuritis those frequently noticed in kidney disease.

The brain symptoms are such as we might expect in toxæmia, viz. headache, vomiting, delirium, convulsions, and coma. In one of my cases there was right hemiplegia with aphasia; in another the most marked tremor of arm and leg. As a symptom aphasia has not been much noticed. Dr. Inglis, whose experience amongst lead-workers is great, met with one case of aphasia which was followed by eclampsia. The aphasia lasted for nine months, and was accompanied by agraphia. Speech returned, but rather imperfectly. The patient is now married, and has several healthy children. In this case eclampsia and aphasia occurred without there being albumen in the urine. The tendency is, however, for the kidneys to become affected as time goes on. The organs are small as a rule, and microscopical examination shows a marked increase of the interstitial tissue.

Although in nearly all our cases of lead-poisoning in Newcastle the kidneys are found to be contracted, and resembling the gouty kidney, though not so red, gout is practically unknown amongst our lead-workers. In only a very few instances have I met with rheumatic arthritis, and in only two have I met with gout, and this was in the case of a young girl who was a lead-worker, and whose father and mother had also both worked in the lead factory and had suffered. The absence of gout in our neighbourhood amongst lead-workers is a subject of more than passing interest, it is one of great physiological importance. I have discussed it with many of the London physicians who have come to Newcastle as Examiners in Medicine for the University of Durham, and with no satis-

factory explanation. They see the association of gout and lead so frequently in London that they are forced to admit the relationship. In the treatise on gout recently published by Sir Dyce Duckworth the subject is discussed at considerable length. His own experience, as well as that of others, is given ; amongst which is the interesting case of Dr. Lauder Brunton, where a few grains of lead and opium pill given for diarrhoea to a painter previously healthy were followed in a few days afterwards by a distinct development of gout. Opposed to this relationship of gout and lead is the testimony given by many physicians of provincial and Scottish hospitals. Amongst the former is the opinion of my colleague Dr. Drummond, who also states that in the north this relationship is never noticed. Our opinion is that in the north of England gout is practically unknown as a symptom of lead-poisoning ; it is the last symptom I should either look for or expect to find. It is to be remembered, however, that gout, generally speaking, is not a common disease with us. I have tried to find an explanation of the absence of gout amongst our lead-workers, but have hitherto failed. I do not think it is altogether a question of malt liquors being drunk by the London workmen, and of whisky by those in the north. What it is I do not at present know. Climatic conditions may have an influence. What we believe is that lead in some way or other so influences the metabolism of the tissues that the ordinary nitrogenous waste is either improperly formed or imperfectly eliminated. In most of my cases there has been a marked diminution in the daily discharge of urea, 200 to 250 grains being the average : in some of the cases under treatment the amount rose to near the normal, whilst in others it diminished. It is to the amounts of uric acid eliminated daily that I would invite attention. Here I admit we are dealing with a difficult subject, since we do not know definitely what diurnal variations of uric acid elimination are consistent with health, but it is upon this point that almost everything centres so far as the development of gout is concerned. Physiologists give

varying amounts for the daily discharge of uric acid; Flint says 6—9 grains, McKendrick 13 grains, Brubaker 8 grains, Kirkes 8·5 grains, Landois 7—10 grains, Ralfe 7 grains, and Foster 7—8 grains.

Now of four cases the details of which were worked out for me by Dr. Bedson, Professor of Chemistry in the Durham College of Science, the following are, roughly speaking, some of the average eliminations.

McNay—for some days before treatment the average quantity was 5·9 grains, and after treatment the average of several days was 7·7 grains.

Miller—before treatment 16·7 grains, after treatment 8·4 grains.

Buglas—before treatment 12·5 grains, after treatment 14·57 grains.

Ruddy—before treatment 7·7 grains, after treatment 7·1 grains.

The methods used by Professor Bedson were for urea the hypobromite of soda; for uric acid Haycraft's method; and for estimating the amount of lead in the urine and tissues the colorimetric test.

In only one of these cases, therefore, was the daily discharge of uric acid below the amount stated by physiologists as the normal. Admitting the correctness of the uric acid theory of gout, there were not in existence in these cases the conditions that lead up to the development of gout, unless circumstances arose to check the elimination of uric acid. On looking again at the charts it will be seen that the daily discharge of uric acid was occasionally twice, sometimes thrice, what it ought to have been. Lead has therefore some peculiar influence upon the formation of uric acid in the system.

Another interesting point is that lead was found daily in the urine of patients under observation; and that under treatment by potassium iodide the amount of lead thrown out daily by this channel increased in quantity. In nearly every case the amount of lead discharged was doubled or trebled.

In Buglas's case the amount of lead for several days at first was $\cdot 0126$ grain ; it rose to $\cdot 334$ grain.

Ruddy, from $\cdot 0208$ to $\cdot 0297$ parts of a grain.

Miller, from $\cdot 042$ to $\cdot 073$ parts of a grain.

McNay, from $\cdot 0035$ to $\cdot 0301$.

The charts also show another interesting point as regards these eliminations : every now and then there seems to have been a kind of explosive elimination of lead and uric acid, and it would appear as if they stood in an inverted relationship to each other. Nothing occurred to predict these sudden rises and falls, nor was anything noticed to follow them.

The other tables show that a very small amount of lead is met with in the tissues after death ; that a small amount after all has been absorbed, and yet has been capable of causing death. Less than one grain of lead found in the brain after death ! this seems a small amount to have caused such terrible suffering and an early death ! True, it represents metallic lead, and we know nothing of how it is combined with the tissues, or even in what chemical form it exists, although there is much to lead us to infer that it exists in some peculiarly complex molecular form. Still I cannot but think that the death is from acute toxæmia, analogous to but not identical with uræmia ; the individual is poisoned by the products of her own metabolism ; her cachexia points to a rapid disintegration of blood, and the presence of lead in the bones and spleen after death lends weight to the opinion that a deep wound has been inflicted upon the blood and blood-making organs.

Can nothing be done to diminish this tendency to lead-poisoning and rapid death ? The blame, I admit, is not altogether due to lead-making. There is an individual predisposition to plumbism. There is a class of women too easily affected by lead, but what that type is it is difficult to say. All I can say here is that many of them are ill-fed, badly housed, and lead a questionable life, and thus, owing to starvation and exposure, may be regarded

as subjects likely to break down quickly under the influence of lead. But to many these remarks will not apply, and consequently these conditions, whilst predisposing or tending to aggravate symptoms when present, cannot be the cause of them.

I would summarize my opinions thus :

1. That women suffer much more frequently and severely than men.

2. That women suffer at an earlier age than men : that, for example, of the 135 patients admitted into the Newcastle Infirmary, whilst up to the age of twenty-three no men were affected, forty-nine women had already suffered ; that after the middle term of life men suffer more than women.

3. That acute lead-poisoning attended by cerebral symptoms is much more fatal amongst women than men.

4. That the most fatal period of lead-poisoning is that time in a woman's life when the menstrual function is extremely active, that this is one of the functions of the body most apt to be quickly disturbed, and that in this way an explanation may be found of the greater prevalence of lead-poisoning amongst women.

5. That death in the acute stage is due to toxæmia, and in chronic plumbism is due to organic changes in the kidneys and nervous system.

6. That gout in the north of England is a very infrequent accompaniment of lead-poisoning.

7. That cardio-renal changes are the most frequent consequences of slowly developed lead-poisoning. That whilst the paralysis known as " wrist-drop " is more frequently met with amongst men than women, women suffer much more frequently from the acute cerebral symptoms.

Cases.

CASE 1. *Sudden death in lead-poisoning.*—Elizabeth Ann T—, æt. 22, single, admitted into the Newcastle Infirmary July 18th, 1889; worked two and a half years at the “white-lead.” After the first three months she was obliged to leave off work for three weeks, owing to colic. She returned and worked for seven weeks, when she was again obliged to leave on account of colic. In August, 1888, she had severe pain in the head, which was followed by partial blindness. She did not return to the factory for two months. Gradually she regained her eyesight, and has since then worked off and on at the lead-works. She began to menstruate at the age of fifteen; her menses, which have been regular, have been scanty since she went to the lead factory. At present the patient is menstruating. For the last few days she has complained of pain in her joints and loss of eyesight. Urine normal, free from albumen. The patient died in a convulsion early on the morning following the day on which she was admitted. The history of the case was obtained from the mother after the death of the patient.

Post-mortem.—Body that of a well-developed female. Blue line on gums. No œdema. Pupils half dilated. Lungs healthy. Pericardium healthy, contains about two drachms of serum. Heart healthy, weighs $10\frac{1}{2}$ oz. Right ventricle—walls flaccid, cavity empty. Left ventricle—wall fairly thick, chamber empty, aortic valve competent. Endocardium healthy, valves all healthy. Liver smooth, healthy, weighs $60\frac{1}{2}$ oz. Gall-bladder contains fluid bile in small quantity. Liver-tissue on section is seen to be pale. Spleen tears easily, is soft and pulpy, weighs $6\frac{1}{2}$ oz. Left kidney $5\frac{1}{4}$ oz. Capsule is removed with ease. On section the veins in cortex and medulla are seen to be injected; otherwise nothing abnormal is detected. Right kidney $5\frac{1}{4}$ oz. Capsule removed with ease. A small quantity of pus is seen exuding from pelvis of kidney, but the lining mem-

brane is not noticed to be injected. Kidney substance rather injected, but healthy. Vagina—hymen absent. Uterus—cervix eroded and granular. Interior of uterus covered with a red slimy material, which may be menstrual. Ovaries—right ovary enlarged, contains two or three corpora lutea, one yellowish, the others rather red, but evi-

Name of organ.	Total lead in parts per million.	Weight of organ.	Grains of lead per weight of organ.			
Lung . . .	7·6	29·0 ounces	0·0964			
Heart . . .	4·12	10·5 „	0·0189			
Liver . . .	37·8	60·5 „	1·000			
Spleen . . .	12·0	6·5 „	0·0341			
Kidneys . . .	10·0	5·25 „	0·0229			
Cerebrum . . .	9·8	51·5 „	0·779			
Cerebellum . . .	24·8					
Pons . . .	22·6					
Spinal cord . . .	1·16					
Large intestine . . .	37·7					
	Alcoholic extract, lead in milligrms.	Ethereal extract, lead in milligrms.	Aqueous extract, lead in milligrms.	Ash, lead in milligrms.	Total lead in milligrms.	Lead, parts per million.
Pons . . .	0·14	0·35	0·0	6·1	0·59	22·6
Cerebellum . . .	0·25	0·4	0·0	1·15	1·80	24·8
Brain . . .	0·3	0·0	0·0	1·35	1·65	9·8

dently not recent ; left ovary smaller, and somewhat cystic. Stomach healthy, small ecchymoses near pylorus in upper wall. Large intestine—longitudinal and circular muscular fibres well developed, mucous membrane distinctly injected. Brain—dura mater slightly adherent at vertex. Sub-

Lead-poisoning Cases admitted into Royal Infirmary, Newcastle-on-Tyne, during Five Years ending June, 1889.

arachnoid fluid has accumulated to excess in the interpeduncular space; pons and cerebellum extremely pale compared with rest of brain, the pallor being particularly noticeable in the pons. The surface of the brain is healthy; vessels not unduly injected. Corpus callosum very pale, as also brain-tissue generally; very few puncta hæmorrhagica. Each lateral ventricle contains two or three drachms of serum. Membranes of brain other than stated above are healthy, and there is no effusion. Spinal cord feels extremely hard and is pale.

CASE 2. *Rapid death in lead-poisoning.*—Catherine H—, æt. 21, single, admitted June 28th, 1889, complaining of pain in the abdomen of eight days' duration. Was always a very healthy girl. She has worked at intervals in the lead factory during the last twelve months, and has suffered thrice from colic during that period. Only three weeks ago she returned to the factory. Her present illness commenced eight days ago with pain at the vertex; her appetite became bad and her bowels constipated. On admission patient appeared to be very ill. She was extremely restless and moaned a great deal, owing to the headache and abdominal pain. She was quite conscious; was very pale. A blue line was noticed on the gums. On the same evening from 6 to 7 p.m. patient had three fits; after 7 p.m. she became quieter. It was noticed that during the fit the left arm moved most. On the following day she was comatose; the pupils were half dilated and reacted slowly to light. Knee-jerk present, slightly exaggerated on left side. Pulse 80, slow; respirations 20 per minute. Heart—first sound over mitral area prolonged, second aortic sound accentuated. She is quite insensitive to pain. Urine, removed by catheter, measured 20 oz., *not albuminous*, sp. gr. 1010. Treatment proved unavailing, the patient never regained consciousness, and she died on June 30th.

Post-mortem.—Brain weighs 48 oz.; the convolutions of both hemispheres are flattened; the veins of the membranes

are gorged with blood. On section the brain substance is seen to be pale, œdematous, and soft. There is slight excess of fluid in the lateral ventricles. Heart—cavities are empty, valves and orifices all healthy. Lungs—left, adherent at places; upper lobe œdematous, lower lobe congested: right lung, lower lobe congested. Spleen

Name of organ.	Total lead in parts per million.		Weight of organ.		Grains of lead on total weight of organ.	
Heart . . .	0·5		7·5 ounces		0·0016	
Liver . . .	41·6		45·0 „		0·819	
Kidneys . . .	13·3		4·5 „		0·0261	
Spleen . . .	39·0		5·0 „		0·0883	
Cerebrum . . .	21·6					
Cerebellum . . .	8·59					
Brain with cerebellum . . . }	30·19		48·0 „		0·634	
	Alcoholic extract, lead in milligrms.	Ethereal extract, lead in milligrms.	Aqueous extract, lead in milligrms.	Ash, lead in milligrms.	Total lead in milligrms.	Lead, parts per million.
Brain . . .	0·6	0·6	0·91	1·3	3·41	21·6

weighs 5 oz., is soft, and is studded with a large number of minute hæmorrhages. Liver weighs 40 oz.; smooth on the surface, pale on section; otherwise presents nothing abnormal. Gall-bladder contains $\frac{1}{2}$ oz. of yellow bile. Kidneys—capsule is readily removed; on section they exhibit nothing abnormal. Intestine normal.

CASE 3.—Mary M—, æt. 20, single, a lead-worker, admitted August 3rd, 1889, complaining of pain in the abdomen, of headache, and of vomiting. Family history good. Four years ago the patient went to the lead fac-

CASE 3. Mary M.—*Daily Elimination of Urine, Urea, Uric Acid, and Lead by the Kidneys.*

tory. After working there for three months she was obliged to desist. For the next two and a half years she was employed as a hawker of fish. A year ago she returned to the lead factory, where she was employed in the "white beds and stoves." Three months afterwards she was again obliged to give up work on account of colic and headache. She was away from the factory for five months, but again returned, only, however, to suffer; for after eight weeks' employment she was again the victim of colic, headache, and vomiting. She is pale, and her features are somewhat full and rounded. Menses appeared when patient was fourteen years of age, and she continued to menstruate regularly until a year ago, when after returning to the lead-works menstruation became profuse, on two occasions the loss being so great that she could not leave the house. This was followed by amenorrhœa, which lasted three months. Since then the menses have been regular but scanty. Pulse 76, soft, compressible. Eyesight is not so good as formerly. Ophthalmoscopic examination by Mr. Williamson, August 4th: Left eye, disc woolly; large myopic crescent surrounding it; slight remnant of old choroiditis. Right eye, old choroiditis better marked here than in the other eye; disc woolly. Patient has never been diplopic, and tells us that her eyesight has never been perfect. Temperature normal. Urine 1027, no albumen, acid, 35 oz. daily average. Patient has excellent teeth, and only the faintest trace of a blue line is noticed on the gum. Tongue moist, clean. Lungs healthy. Heart, beyond slight reduplication of the first sound over the mitral area nothing abnormal is detected. There is a venous hum in the neck. In the abdomen nothing abnormal is detected. Treatment consisted principally of sulphate of magnesia with hyoscyamus and tincture of ginger, and in a fortnight all her pains had disappeared, and her eyesight had considerably improved.

CASE 4.—Elizabeth B—, æt. 26, married, admitted into the Newcastle Infirmary October 30th, 1886, complaining

CASE 4.—Elizabeth B—.

Daily Elimination of Urine, Uric Acid, and Lead by the Kidneys.

of obstinate constipation, pain in the abdomen, and sickness. She is a pale anæmic woman, with rounded features ; very distinct blue line on the gums ; internal squint of left eye, the pupil of which is slightly more dilated at times than the right. Has been married four years ; never miscarried ; has never had children. Menstruation began when fourteen years of age, and has been quite regular ; never had menorrhagia. Seven weeks ago she went to a lead factory, where she was engaged in the "stoves," carrying and drying white-lead. Was perfectly healthy when she went there ; has since lost much of her colour. After working two weeks in the factory she had epistaxis. This continued more or less for more than half a day. Previous to this she had been losing her appetite ; she was scrupulously careful in regard to washing her hands before eating, and took freely of the acid drinks provided. During the third week she began to suffer from pains in the abdomen, accompanied by distension and constipation. This was followed by vomiting every time she sat down to a meal. A disagreeable taste in her mouth too was felt, and her gums now showed the blue line. Urine alkaline, sp. gr. 1022, no albumen ; contains phosphates ; 60 oz. of urine passed daily on an average. Lungs healthy. Heart—first mitral sound reduplicated, otherwise the sounds are healthy. Abdomen—pain is felt over the transverse colon, relieved by pressure. Blood contains 2,620,000 corpuscles in 1 cubic mm. ; there is one white corpuscle to 261 red. The patient was treated by means of bismuth, morphia, and belladonna, and made a good recovery.

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' Third Series, vol. ii, p. 11.)