as that of the patient in Case 10 possible at the end of the nineteenth century? In most cases it would be just as well to frankly resort to craniotomy as to bring on premature labour at 28 or 30 weeks, when the pelvis is so contracted that a genuinely viable child could not pass. From such experience as I have had myself, and from the information obtained by reading numerous statistics and case-contributions from many lands, I believe that it requires very exceptional conditions to make it a justifiable thing to bring on premature labour earlier than in 34 weeks. If you look at the indications for Cæsarean section and compare them with those for the induction of premature labour you cannot fail to be impressed with the shrinking of one and the expansion of the other.

On this subject of premature children Pinard presumes a fuller knowledge than the world possesses when he says: "Nous savons à la fin du XIXe siècle la signification du mot *prématuré*. Nous connaissons l'abîme qui sépare le prématuré de l'enfant à terme, et la différence d'avenir qui est réservée a chacun d'eux." Pinard has done much to add to our knowledge, as distinguished from our impressions, of the fate of premature infants. He refers to the portion of the Paris Maternité where premature infants are taken care of as "établissement modèle où rien n'a été épargné, ni la science, ni le dévouement, ni l'argent"; and what is the result? In 1897, out of 391 infants admitted 292 died within the average time of one month, that is, 70·4 per cent.; and in 1898, out of 482 admitted 343 died within the same average of time, that is, 71 per cent. The relative indications for Cæsarean section and craniotomy on the living mature fœtus would lead me too far afield. The subject is vastly too large for mere *obiter dicta*. One can only ask in half-despair, How long into the twentieth century will the obstetric art continue to act as procuress to invincible ignorance and brutish self-indulgence? Look once more at Case 10: craniotomy on a mature fœtus, craniotomy on twins, craniotomy after induction of premature labour at seven months—that sort of work throws into the shade the practice of an Egyptian midwife.

Manchester.

AN ACCOUNT OF THE EPIDEMIC OUTBREAK OF ARSENICAL POISONING OCCURRING IN BEER-DRINKERS IN THE NORTH OF ENGLAND AND THE MIDLAND COUNTIES IN 1900.[1]

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FOR the last 12 months I noticed, both in the medical wards of the Manchester Workhouse Infirmary and in the out-patient department of the Manchester Royal Infirmary, a considerable number of cases presenting unusual skin eruptions of a more or less indefinite character, such as erythema, keratosis, and pigmentation, the last being particularly common among the pauper patients. Some of the pigmented cases were diagnosed as Addison's disease by my assistants, but I could never satisfy myself that this diagnosis was correct. In June, 1900, about six patients presented themselves in one week who were suffering from the typical erythromelalgia or painful red neuralgia of Weir Mitchell, not only the feet but in some cases the hands also being affected; so marked were these cases that in June I gave a clinical lecture on the condition to the students of the Manchester Royal Infirmary. During the last seven months I noticed a remarkable increase in the number of cases of herpes zoster, which appeared to be in epidemic form and during this period I saw probably more cases than I had seen altogether in the past two years.

At the beginning of August quite an extraordinary number of cases of so-called "alcoholic paralysis" were admitted into the workhouse hospital, principally among women. So-called alcoholic peripheral neuritis is a fairly common disease in the Manchester district, very much more common, as I understand, than in London and the south, and perhaps I may be excused for saying that we are specially well acquainted with the affection, for it was principally owing to the work of our physicians, Dr. J. Dreschfeld and the late Dr. J. Ross, that such excellent descriptions were given to the medical world. By it we understand a peripheral neuritis associated with paræsthesiæ and numbness in the hands and feet, paralysis of the arms and legs, cramps of the muscles, and especially great pain on pressure of the muscular masses of the limbs; in addition, there is frequently a dilated left heart with cardiac muscle failure and marked œdema of the trunk and legs and often albuminuria; very rarely, indeed almost never, is there any affection of the cranial nerves. In some cases there is an almost characteristic mental condition with loss of memory for time and place. It may be at once mentioned that the only forms of peripheral neuritis associated with great muscular pressure and pain are the alcoholic, the arsenical, and that form found in beri-beri. By "alcohol paralysis" or neuritis in this paper I mean *so-called* alcoholic paralysis or neuritis.

This great increase in the number of cases of alcoholic neuritis was noted by many observers, some of whom thought that it was due to increased drinking owing to the war fever or to a wrongful expenditure of the money given by the charitable towards the war funds. There was at the beginning of November no longer any doubt that a serious epidemic existed not only in Manchester and Salford but also in neighbouring towns. Now, rightly or wrongly, and this is a matter far too large and important to discuss in this paper, I have for many years doubted whether ethylic alcohol *per se* does cause peripheral neuritis at all, and I have personally felt more confirmed in this opinion each succeeding year. I was therefore in the present epidemic not content with the alcoholic theory but was at once on the look-out for some other possible cause of the neuritis. I could not at first find a satisfactory explanation, but at any rate I confirmed a previous opinion[2] that in this district alcoholic neuritis only occurred among beer-drinkers, not amongst pure spirit-drinkers. Then we noticed at the workhouse that the peculiar skin lesions already mentioned in passing were very often found in the patients who were suffering from neuritis; secondly, a few cases of beautiful herpes zoster were found in the neuritic cases. Thereupon I remembered that arsenic was the only known drug which produced herpes, and so if there was any known drug acting as a poison in the beer it was almost certainly arsenic.

Improbable as this hypothesis at first seemed, yet it was a valid hypothesis, for it was not known to be untrue; it explained all the facts and it was easily capable of proof or disproof. This hypothesis I imagined on Nov. 15th, 1900. On Nov. 17th I obtained some of the beer most commonly partaken of by the sufferers and on Nov. 18th by Reinsch's test I easily obtained a deposit on the copper foil and driving this off in a combustion tube I got well-marked crystals of arsenious oxide, and thus the hypothesis became a fact.

Source of the arsenic.—On speaking to Dr. H. A. G. Brooke about the skin lesions he told me that he was treating a young London hop merchant for similar eruptions, and by his kindness I saw the patient with him and we found that he had undoubtedly got slight arsenical poisoning, although he took very little beer; but he frequently chewed hops, and we concluded that the sulphur with which the hops were treated would be found to be the source of the arsenic. This was soon found, however, not to be the cause of the present epidemic, especially as so little hops are used in making cheap beers. I have, however, been informed that the sulphur is often contaminated with arsenic, and in this way hops on the market often yield a reaction, showing the presence of traces of arsenic, thus accounting for the symptoms in a gentleman constantly tasting them. I communicated my discovery of the arsenic to Professor Dixon Mann on Nov. 19th and on Nov. 20th he examined a different sample of beer and also found arsenic. He informed Professor S. Delépine, who was, unknown to me, also investigating the epidemic at the request of Mr. C. H. Tattersall, the medical officer of health of Salford, and he on Nov. 22nd traced the arsenic to certain sugars used in brewing. These were invert sugar, made by the action of sulphuric acid on cane sugar, and glucose, made by the action of sulphuric acid on various forms of starch. It was easy to see that the sulphuric acid was the common source of the arsenic, and

[1] A paper read before the Royal Medical and Chirurgical Society on Jan. 8th, 1901. An abstract was published in THE LANCET of Jan. 12th.

[2] See Medical Chronicle, June, 1890, p. 189.

on being examined large quantities were found, the original source being the Spanish pyrites from which the sulphuric acid is made and which often contains a very large percentage of arsenic. As it happened the brewing sugars from one firm only were found to be thus contaminated, but as this firm supplies no less than 200 breweries in the north of England and midland counties it will be seen how widespread the epidemic was likely to be.

Quantitative analyses.—By the kindness of Professor Delépine I am able to give some interesting quantitative determinations, the arsenic being estimated as arsenious oxide. Various beers were found to contain from two to over four parts per 1,000,000—that is, from 0·14 to 0·3 grain per gallon. The invert sugar contained 0·25 part per 1000, the glucose 0·8 part per 1000, and the sulphuric acid no less than 1·4 per cent., or four ounces per gallon.

Other sources of arsenic.—From a legal and commercial point of view these results are of the highest importance, but from a scientific point of view it is equally important to know that traces of arsenic may get into beer from other sources. I have already mentioned that it is contained in sulphured hops; it is also found in many samples of malt, getting there either from sulphur or from anthracite coal; it has been found by Dr John Brown of Bacup in the vulcanite tubing used for conveying the beer to the pumps. Again, calcium bi-sulphate and sulphuric acid are used in "fining" the beer, and also, I believe, for cleansing the barrels. Another point worth recording is that many artificial manures are contaminated with arsenic. A possible explanation of the manner in which arsenic may be retained in beer during the various processes and may be of peculiar virulence is that according to the researches of Selmi, Hamberg, Sanger, Saccardo, and others,[3] certain micro-organisms, especially aspergillum glaucum, mucor mucedo, and penicillium brevicaule, seem to have a special tendency to seize hold of any arsenic in their vicinity and to manufacture specially poisonous arsenical products. This has so far been worked out more particularly in connexion with arsenical wall-papers, but, as Dr. R. T. Williamson[4] points out, it is very desirable that further researches on these arsenio-bacteria should be made.

Extent of the epidemic.—Although the epidemic seems to have fallen most heavily on Manchester and Salford and the vicinity, yet many more distant towns in the north of England and the Midlands have been affected—wherever, indeed, the contaminated brewing sugars were used. Thus we hear of outbreaks in Liverpool, Chester (where the cases were associated with so much heart failure and so little pigmentation that they were diagnosed as beri-beri), Warrington, Heywood, Bacup, Preston, Lancaster, Penrith, Ilkley, Leicester, Stourbridge, Lichfield, and Darleston.

Although very many thousands of people have probably been affected, yet it is impossible to say how many and equally impossible to give the number of deaths. For the epidemic had been in existence for nearly six months before anything except alcohol was suspected as the cause; many cases were treated as rheumatism, others as gastritis or diarrhœa, large numbers simply for the skin eruptions, and many merely as cases of chronic alcoholism. Some patients only had slight symptoms and did not have medical attention, while in others the cardiac and hepatic symptoms were the important features. But some idea may be obtained from certain statistics obtained by Dr. J. Niven, medical officer of health of Manchester, and Mr. Tattersall, medical officer of health of Salford. The former in response to a circular received information from 90 practitioners and came to the conclusion that there had been up to the end of November in Manchester only at least 2000 cases. Investigating his death tables, and including deaths certified as due to neuritis, alcoholism, or cirrhosis of the liver for the first 10 months of the years 1897, 1898, 1899, and 1900, he found them to amount to 172, 141, 188, and 253 respectively. In Salford Mr. Tattersall found that in the four months from the end of July to the end of November, 1900, there were 41 cases of death certified as due to neuritis and 25 as due to alcoholism; this total of 66 contrasted with 22 in the first seven months of the year, 39 in the whole of 1899, 31 in 1898, and 27 in 1897.

SYMPTOMATOLOGY.

1. *Complaint of patient.*—In answer to the usual question "What is the matter with you?" the patients have complained of one or more of the following symptoms: pains in the feet, hands, and limbs, burning in the soles of the feet, tingling and "pins and needles" in the fingers and toes, shooting neuralgic pains in the trunk and limbs, difficulty of walking, weakness in the hands and legs, rashes on the body, frontal headache, running of the eyes and nose (cold in the head), bronchitis and hoarseness, a "tired-out" feeling, shortness of breath, swelling of the feet, vomiting, and diarrhœa.

2. *Aspect.*—The aspect of most of the patients is so typical that their cases can generally be diagnosed at sight, not only as they come into the out-patients' room, or lie in bed, but as they walk about the streets of the city. The face is puffy, especially about the eyelids. The eyes are suffused and watery and sometimes running with tears, in some cases the conjunctivæ being œdematous and the vessels so congested that at first sight there appear to be sub-conjunctival hæmorrhages. The colour of the face varies from crimson to a dusky red or even a copper colour. The voice is often "husky," sometimes intensely so, and the walk is that of a patient with very sore feet, so that they seem afraid to put the foot to the ground, or it is somewhat unsteady, or else there is the "high stepping" gait from paralysis of the dorsal flexors of the ankle; in many cases the gait can be diagnosed merely by the noise of the footfall on the ground, the "double-rap" step, as I call it, the heel coming down first, quickly followed by a sudden (not gradual, as in health) descent of the anterior part of the foot and so making the second rap. The patients very frequently are found to be rubbing the fingers together because of the numbness and tingling.

3. *The skin lesions.*—These are very numerous, and almost invariably present in some form or other in greater or less degree. (*a*) Erythromelalgia. This condition, described as "painful red neuralgia of the extremities" by Weir Mitchell, or "acrodynia" by older observers, was one of the commonest lesions. The soles of the feet are crimson, as if stained with red ink, sometimes the whole surface, but more generally only where the surface touches the ground, so that there is left a normal appearance on the inner side at the hollow of the foot and also a transverse line just beyond the distal extremities of the metatarsal bones. The sole, and often the whole foot, is bathed in perspiration which may be stinking (but this is rare). The skin is also puffy even if no true dropsy is present. On the palm the redness may again be uniform but again more frequently it is most marked on the thenar and hypothenar eminences and on the palmar surfaces of the terminal phalanges, the centre of the palm being normal in colour; the whole palm is wet and may be actually pouring with sweat. Both soles and palms are tingling and burning hot and painful, and these signs are greatly intensified by heat, so that the patients cannot sleep unless the feet are exposed to the air outside the bedclothes.[5] The pressure of the bedclothes cannot be borne and the surfaces are exquisitely painful on pressure, so that, as I have said, the gait is affected, and the patients cannot use the hands even if no paralysis is present. This erythema does not become pigmented, but passes on to keratosis. (*b*) Keratosis. This condition seems to be a somewhat late manifestation and is at any rate very frequently secondary to the erythema and hyperidrosis of the palms and of the soles. I have watched it develop on the hands and feet and can thus speak with some certainty. It may take several forms, it may be in a few isolated scaly masses, either thin or very heaped up in marked prominences, and in this way previous corns on the feet or patches of tylosis on the soles or palms become extraordinarily prominent. In some cases the keratomatous patches appear on the dorsum of the hand between the webs of the fingers and on the knuckles. In more marked cases either the whole palm or sole is thickly covered with large white or dirty grey scales which are constantly being shed into the bedclothes; or the centre of the palm and inner side of the sole may be merely erythematous and dry but not covered by scales. Sometimes the keratosis extends up to the ankles and on to the wrists, but the scales are now not thick but more like a branny desquamation. The palms and soles may both be affected, but the soles are almost always the worst, and sometimes are affected alone. Moreover, in cases where

[3] Allbutt's System of Medicine, vol. ii., p. 989.
[4] Brit. Med. Jour., Dec. 1st, 1900.

[5] Rarely the patient says his feet are very cold, but on examination they are found to be hot.

there is no pigmentation keratosis may be present and forms a most valuable aid in the diagnosis of a case which might otherwise appear to be merely one of alcoholic paralysis. The process is very slow (many weeks) in its development and seems to be if untreated extremely chronic. (*c*) Erythemata. These are very varied in character and are often accompanied by great irritation. There is sometimes a scarlatiniform eruption on the upper part of the chest spreading to the neck and face, sometimes on the forearms and rest of the body. At other times, and perhaps most frequently, it is a morbilliform rash on the trunk and limbs running into scarlatiniform patches; often it is a more distinctly papular erythema and not infrequently there is an acute urticaria. In some the change is so intense that there is a vesicular eruption in which the lesions may vary in size from that of a pin's head to large bullæ several inches in diameter; those which I have seen have been almost always on the limbs. In one or two cases the appearance has been that of a true pemphigus, and when the contents have been shed circular marks have remained, like very superficial scars. These vesicular eruptions are probably a late form of rash, even coming on six weeks after the last glass of beer has been taken. The erythematous papules sometimes become larger, run together, and are covered with scabs in patches, so that there may be after many weeks an appearance somewhat like lupus or even of superficial syphilitic ulcerations. (*d*) Pigmentation. This is generally not present in light-complexioned patients or merely amounts to a darkening of pre-existing freckles. In darker people it is practically always present in greater or less degree, but in many is so diffuse that it may entirely escape notice. In most of the cases it follows (after many weeks) the erythematous blush, which gradually turns from red to copper-colour, then to bronze, and in severe cases almost to black, so that many of the patients resemble mulattoes. Even if it is thus almost universal it does not affect the palms and soles nor, as a rule, does it touch old scars in which the deeper layers of the skin have been destroyed, but round the edge of the scar it is much intensified, the scar thus seeming to be of an especially white character. Round the neck, in the armpits, round the nipples, on the abdomen, round the genitals, and on the buttocks, where there has been pressure, as round the waist or under the garters, it is much deeper in tint and, indeed, resembles the pigmentation of Addison's disease; but I have not seen any pigmentation of the mucous membrane of the mouth. Although well seen on the face of many patients yet on the whole it is more marked on the trunk. Frequently the pigmentation shows well-marked lighter spots like "rain-drops." In other cases the pigmentation is seen on close examination to be punctiform. In others it is in isolated spots varying in size from a pinhead to patches equal in size to the palm of the hand, clear light-coloured skin intervening, and often these isolated patches run together to form a continuous pigmentation. Not only is the colour like that of a mulatto but the texture of the skin takes on the same beautifully soft velvety feel to the touch, quite different from that of normal English skin. In many cases after many weeks a branny desquamation of the pigmented skin takes place, so that by friction one can rub off the pigmentation as it were and leave healthy skin underneath. Having watched numbers of these cases for weeks I am convinced that there is a distinct sequence of events — namely, an erythema followed by pigmentation and then a desquamation—so that the pigment is really a part of the general altered nutrition of the skin and is not due to a deposit of metallic arsenic in the skin as was once thought; this view does not necessarily exclude the idea that the drug may be partly eliminated by the skin. (*e*) Herpes zoster. This was the tell-tale eruption which, as I have said, gave me the key to the puzzle. When it occurred without any other very definite symptoms, then I considered that I was dealing with epidemic specific herpes, but when I found other signs of arsenic poisoning present there could be no doubt that it was also arsenical in origin. Since the discovery of the arsenic practically every case of herpes zoster has been found to have other unmistakeable signs of arsenic poisoning in greater or less degree. I have seen rarely herpes of the fifth cranial nerve, a few cases of the ascending branches of the cervical plexus, several of the other cervical nerves, many of the dorsal nerves, and one of the first lumbar nerve. In no case has the herpes been bilateral and generally only one nerve-root was affected, but in two cases I have seen two succeeding nerve-roots affected; I have seen no herpes below the elbow or below the knee. From the great number of cases seen in this district there is to my mind no longer any doubt that arsenic causes herpes by a direct action on the posterior spinal ganglion, just as much as it acts directly on the motor and sensory nerve fibres; this seems to me to be a much more probable view than that put forward by Dr. H. Head, that arsenic is only a remote cause of herpes, inasmuch as it renders a person more liable to attack by specific herpes. In fact, how many of the epidemics of so-called specific herpes (such as that described by Dr. Head as occurring in 1897 during the long drought that lasted from July to November) have not really been due to arsenical poisoning? From actual therapeutical observation I have seen a few cases of herpes develop when I have been giving small doses of arsenic in which the only other sign of arsenical poisoning was lacrymation and a silvery tongue. I am indeed convinced that it may come on with quite small doses. The herpetic eruptions have always been preceded and accompanied by very severe neuralgic pains along the course of the nerve or nerves affected. And I may here state that I have had many cases with severe neuralgic pains in the arms or round one side of the trunk which I expected would be followed by herpes, but none appeared. (*f*) Nails. In many cases the nails are affected. After the patients have stopped taking the beer for some weeks the best appearances are seen, for then there is a transverse white ridge across the nail; proximal to this the nail is normal, but distal to it the nail is whiter, cracked, thin, and towards the tip almost papery and much flattened. In some cases there have been a series of parallel transverse ridges on the nails almost suggesting a series of week-end "drinking bouts." These deformed nails of course break easily. (*g*) Loss of hair. One or two women have told me that they have lost the hair during the attack, but this has certainly not been a marked feature.

4. *Nervous system.*—(*a*) Sensory affections have been present in practically all the cases. In the mildest they have merely consisted of paræsthesia and tinglings and burning and pricking sensations in the fingers and toes; in others these conditions have been combined with numbness of the hands and feet and sometimes of the legs below the knees. I have not seen a case of *total* loss of sensation, although the numbness has been very pronounced. Part of the apparent loss of power in the hands and feet has been due to this partial loss of sensation. In one case there was very marked, but not total, anæsthesia of the whole left fifth cranial nerve, but its motor fibres were unaffected. This is the only instance in which I have seen any affection, either sensory or motor, of the cranial nerves. Neuralgia of the arms or trunk, either followed or not by herpes, I have already alluded to. Finally, and of the greatest diagnostic importance, there was in a large number of the cases (but only if there was some loss of power) tenderness on pressure of the muscular masses of the legs and arms; sometimes deep pressure was required, but in other cases light pressure produced most exquisite pain and caused the patients to scream out and to exhibit a very typical facial expression of terror or in less marked cases merely a screwing up of the facial muscles in a "grin of pain." (*b*) Motor. These symptoms were similar to those ordinarily found in so-called alcoholic neuritis They were present in greater or less degree in about 70 per cent. of the cases. In the slighter cases there was only slight loss of grip and slight affection of the gait, and there was then no appreciable atrophy of the muscles. In more marked cases there was a total paralysis of the affected muscles with very marked atrophy. The small muscles of the hands, especially the interossei, the muscles of the forearms, especially the extensors, and in severe cases all the muscles of the arm, were involved. If the muscles of the upper arm were not affected then also the supinator longus escaped to a large extent, as in lead-poisoning. In the early stages in the feet there was loss of power with some slight irritation of the extensors of the toes, so that the great toe was well extended and "cocked-up." In this stage the knee-jerk was always either present or exaggerated, but there was never any ankle clonus. But soon the muscles became paralysed and atrophied, first the interossei and the anterior tibial and peroneal groups, so that the toes were flexed and the whole foot dropped at the ankle into a position of talipes equino-varus. The calf muscles were next affected and at about the

same time those of the thigh, accompanied, of course, with rapid wasting and loss of the knee-jerks. The superficial reflexes were normal or exaggerated. Even in this stage the muscles on the front of the trunk were weak, so that the patients could not raise themselves in bed, and in some advanced cases there was well-marked diaphragmatic paralysis, with laboured breathing and a markedly ineffective power to cough. In one case with comparatively slight loss of power in the limbs the diaphragm was entirely paralysed. It goes without saying that in the most advanced cases the patients lay in bed totally helpless. There was no paralysis of the sphincters except in the most marked cases, in which some of the incontinence was possibly due to the mental condition, and the intercostal muscles were never paralysed. I never saw any paralysis of the cranial nerves in any case. The walk I have already described as a "stepping" gait, but many of the patients were distinctly incoördinate in their movements, and swayed slightly on standing with the eyes closed, but to my mind there was never any real resemblance to the ataxic walk of a case of tabes. (*c*) Mental. In many of the cases of advanced paralysis there was the peculiar mental condition commonly found in alcoholic paralysis. This has been called "confusional insanity," but it is more accurately described as a total loss of memory of time and then of place. There is a loss of initiation of ideas, but any suggestion, however absurd, is at once accepted. Thus a totally paralysed patient who has been in bed for weeks when asked if he has not been for a walk this morning will say that he has and will tell you with much circumstance where he has been; and when asked about yesterday will perhaps say with a little prompting that he has been to the seaside. If asked when he came into hospital, he will always turn towards the nurse at the other side of the bed and say: "Let me see, I think it was yesterday [or some other near date], wasn't it, nurse?" But, taking only the paralysed cases, I am inclined to think that the amount of mental confusion has been distinctly less than I should have expected from as many cases of ordinary alcoholic paralysis, which rather leads me to think that arsenic has not much effect on the cerebral cortex.

5. *Circulatory system.*—In the majority of the patients there has been some heart failure. In the milder cases this has been limited to dyspnœa on slight exertion, palpitations, post-sternal or epigastric pain, and a low tension pulse. In more marked cases the heart muscle has shown great failure and the left side of the heart has been dilated, the apex-beat has been in or outside the nipple line, and the left border not infrequently outside the nipple line; the beat was sometimes diffuse. On auscultation the heart sounds have approached the fœtal "tic-tac" type, the second sound being accentuated and the diastole shortened to the length of the systole; in some cases there was a soft systolic mitral murmur. Exertion has increased the pulse-rate considerably and there has sometimes been a rapid heart without accompanying fever. So great has been the cardiac muscle failure that several patients have fainted on getting up for the first time, and undoubtedly the principal cause of death has been cardiac failure; this has been noticed as the chief cause of death in arsenical poisoning by Brouardel in the Havre epidemic in 1888 (homicidal poisoning). Œdema affecting merely the feet only or almost the whole body has been observed in 25 per cent. of the cases. On the trunk it may manifest itself by the skin taking and retaining the impression of the stethescope over the heart. There is often a well-marked pad of œdema over the sacrum, and the genitals are sometimes enormously œdematous. The legs may have such a tense, hard œdema that it is difficult to make an impression on them with the finger. There has been a fair amount of ascites, but no great amount of pericardial or pleuritic effusion, certainly not so much as is said to occur in beri-beri. In the Chester cases there seems to have been an unusual amount of heart failure and œdema. Both from the cases which I have seen and from those reported in other epidemics I have no doubt that arsenic will seriously affect the heart muscle quite independently of alcohol.

6. *Respiration.*—Just as the skin is irritated by the arsenic so the respiratory mucous membrane seems to be in its whole course. There are in the early stage running from the eyes and nose, congestion of the fauces, a very marked congestion and thickening of the vocal cords producing the typical hoarse or husky voice (not due to any paralysis, as I have proved by laryngoscopic examination), and very pronounced bronchitis. Not infrequently there has been hæmoptysis in patients who were certainly not suffering from phthisis. Not a few of my cases have shown signs of phthisis with fairly rapid breaking down of the lung tissue. And it is interesting to note at the present time, when arsenic is being largely recommended for the treatment of phthisis, that some of our patients with signs of rapid phthisis give a history of apparently previous phthisis which has seemed to be in abeyance but has been lighted up in a virulent form by drinking the arsenicated beer.

7. *Digestive system.*—In many of the cases digestive troubles were the first signs; although loss of appetite was present in severe gastric cases, on the contrary in mild cases the appetite seems to have been definitely increased. There was, of course, no blue line on the gums in any case, but in a few the gums were red and softened. The tongue in the early stage had a typical thin white silvery coat, as if if it had been brushed over with lunar caustic. In later severe stages it was brown, but as a rule it was moist. Vomiting, quite sudden and very copious, was a marked feature, sometimes occurring immediately after each pint of beer taken or immediately after a meal. Many patients came to the hospital suffering from sensory disturbances and said that they were spirit-drinkers only, but on inquiry I found that they had been beer-drinkers a few weeks previously, but had voluntarily stopped the beer because it was not "agreeing" with them, as they were so sick, and this occurred before it was known that arsenic was present in the beer. Some patients complained of diarrhœa, and as these cases occurred in October and November I was quite at a loss to explain the cause, especially as they had not as yet shown other signs of arsenical poisoning, although they were obviously alcoholics. In a few cases there has been passing of blood by the stool, but whether this was secondary to congestion of the liver or to ulceration of the intestine I cannot say. At the work house hospital during the last six months we have had quite an unusual number of cases of cirrhosis of the liver (this organ being much enlarged, hard, and tender), with great ascites. Dr. A. C. Sturrock, the resident medical officer at the Manchester Royal Infirmary, has noticed the same increase there.[6] Brouardel has also mentioned cirrhosis of the liver in pure cases of arsenical poisoning, and I cannot doubt but that arsenic will set up an interstitial hepatitis.

8. *Urine.*—In a considerable number of cases there has been a trace of albumin in the urine, but quite possibly this has been secondary to the cardiac failure. In many cases this disappears later, so that I have no evidence to prove that there has been renal cirrhosis. We have not found any sugar in the urine. But a more interesting and important fact is the presence of arsenic in the urine of those patients who had been drinking quite recently. Professor Dixon Mann on Nov. 26th obtained the arsenical reactions quite easily from only six ounces of urine passed by a woman who had been recently drinking, and its presence in the urine has also been detected by Dr. J. H. Abram and Dr. Nathan Raw[7] and others. There is no doubt also that the arsenic is excreted by the milk, as I was informed by a mother who was affected that her suckling child vomited after each meal (which had never been the case with any of her previous children). Mr. G. S. Taylor of Salford[8] reports also a clear case of the suckling infant being affected.

9. *Temperature.*—In the early stages in several cases the temperature has been raised, varying from 101° or 102° F. in the morning to 102° or 103° in the evening, the other signs of early arsenical poisoning being fairly acute. In some cases this pyrexia has disappeared after a week or 10 days in bed; in other cases it has lasted two or three weeks, and in a few it has continued until death. Thus in the early stages in previous epidemics there has been some excuse for the cases having been diagnosed as influenza or even as typhoid fever.

Summary of symptoms and order of sequence.—From the above account it is clear that arsenic is almost certainly a cumulative poison although some authors say that it is not so. Moreover, it is a poison which affects both the skin and the respiratory and digestive mucous membranes, the nerve trunks, both sensory and motor, and the muscles (including the heart muscle), and the liver. As regards the sequence of the symptoms Brouardel[9] has clearly laid them down and I can confirm his statements. The sequence is: (1)

[6] Brit. Med. Jour., Dec. 22nd, 1900, p. 1815.
[7] Ibid., Dec. 8th, p. 1683.
[8] Medical Press and Circular, Dec. 5th, 1900, p. 585.
[9] Annales d'Hygiène, 1889, p. 479.

digestive symptoms; (2) laryngeal catarrh, bronchitis, and acute skin symptoms; (3) disturbances of sensibility; and (4) motor paralysis (and pigmentation and keratosis). Widal in the Hyères epidemic gives the following actual dates in one of his cases: Feb. 8th, gastric disturbance and diarrhœa; March 4th, acute cutaneous eruptions, spasmodic cough, running of the eyes and nose; March 31st, sensory disturbances in the limbs, then some days later paresis of the upper and lower limbs. Health was only restored after one year.

The course of the disease is a slow one. The gastric, coryzal, and laryngo-bronchial symptoms pass off first, then the acute skin lesions, which pass on to the chronic skin lesions, which, I think, will be found to last many months. The erythromelalgia and sensory symptoms are still almost as marked as ever in patients whom we have had under observation for four or five months, and judging from analogy of so-called alcoholic paralysis the motor disturbances will last for from 18 months to two years before they entirely disappear.

Mode of death.—In most of the cases this seems to be from cardiac failure, either quite suddenly or gradually. Some patients have died from paralysis of the diaphragm with secondary broncho-pneumonia, and in one case at least phthisis contributed to the fatal issue.

Classification of cases.—The cases may be roughly divided into groups: (1) those with all symptoms fairly well marked; (2) those with skin lesions principally; (3) those with cardiac and hepatic lesions principally; and (4) those with paralytic lesions principally. A careful examination into the history and present state of any case will, however, reveal some concurrent symptoms quite characteristic of arsenical poisoning. Thus in a fair-complexioned woman who had no apparent symptoms but paralysis, which could not be diagnosed from so-called alcoholic paralysis, there was in addition keratosis of the soles of the feet.

Diagnosis.—Once the possibility of arsenic poisoning is recognised there is no difficulty whatever in diagnosis. There is no other disease which will produce the same grouping of symptoms. In the early stages it is possible to mistake the condition for measles or scarlet fever and in the later for Addison's disease, and in some cases it will be difficult in the present state of our knowledge to say that certain cases cannot be entirely explained by chronic alcoholism. Only a thorough consideration of the history and full examination of the patient will prevent mistakes being made. In beri-beri there are said to be but few skin lesions.

Treatment.—I shall say little on this point, for having entirely stopped the intake of the poison, the treatment becomes merely a matter of dealing with symptoms. One point, however, is of great importance; on account of the alarming heart symptoms from muscle failure no depressing drugs should be given. We must thus avoid potassium iodide, sodium salicylate, antipyrin, exalgin, phenacetin, &c. Small doses of digitalis, with some other diuretic, tonic doses of strychnine, gastric sedatives, carbonate of ammonia, and senega, will probably be required. For the pains we must have recourse to small doses of morphia. The burning sensation in the hands and feet is much relieved by spirit lotion. The other skin lesions must be dealt with *secundum artem*, but this is a subject which I would rather leave to the dermatologists. The treatment of the neuritis does not differ from that which is already well known.

Previous epidemics.—Space will not allow me to do more than mention some previous epidemics of arsenic poisoning. Graves[10] mentions that he had witnessed part of the curious "*épidémie de Paris*" which occurred in 1828, in which there were peripheral neuritis, acrodynia, and many other of the symptoms which I have above described. There can be little doubt that this was an epidemic of arsenic poisoning. I have been unable to find Chomel's original paper, but Barthélemy[11] says, also, that it appears to have been due to arsenic and that in four or five months it caused the deaths of 40,000 persons on the western bank of the Seine near Paris. Brouardel and Pouchet[12] call attention to an epidemic affecting nearly 500 persons at Hyères in 1888 and reported by Widal, in which white arsenic had by mistake been put into wine instead of gypsum; also an epidemic at Havre in 1888 in which 15 persons were affected from arsenic put intentionally into food. Brouardel also alludes in passing to an epidemic, which he had investigated, from arsenic in bread,[13] and I have seen a statement made, but cannot confirm it, that in 1884 in the Département du Midi (France) some wine sold was found to contain a considerable quantity of arsenic which was derived from the sulphuric acid with which the old wine barrels had been repeatedly washed, whereas the same wine which had been stored in new barrels was quite free from the poison.

Pathological anatomy.—This subject I do not intend to allude to, as it is being investigated by others. In the few cases in which I have been present at the post-mortem examinations the only prominent signs were the interstitial hepatitis and the dilated flabby heart.

Personal statistics.—During the three months—October, November, and December, 1900—I had charge at the Manchester Workhouse Infirmary of 343 patients suffering from arsenical poisoning, 192 being men and 151 women. During November and December at the Manchester Royal Infirmary (out-patient department) I treated 157 patients similarly affected, 99 being men and 58 women. This gives a total of 500 cases, 291 being men and 209 women. This preponderance of men over women is contrary to what I supposed at first was the case, but the symptoms were on the whole more pronounced in women. The deaths were 13, five of men and eight of women. The ages varied from 26 years to 70 years and either beer or porter was invariably taken as a beverage, alone or together with spirits. The amount taken has varied from as small a quantity as two pints (possibly only one and a half pints) to 16 pints a day. The herpes was more common in men, for out of a total of 21 cases seen in three months 16 were in men. The heart symptoms with anasarca and the liver enlargement and cirrhosis with ascites were also more common in men. But the gastro-intestinal, the coryzal, and the sensory and motor disturbances were more common in women and as a rule were shown in a much more marked degree. In 80 cases in which specially careful notes were taken seven women out of 37 had marked loss of memory of time and place, but only one man out of 43 was thus affected. Also of these 37 women 27 were suffering from loss of power, 10 of them to such a degree that movement of the much atrophied limbs was practically impossible. Of the 43 men 17 had loss of power, the loss being of a total character (in the limbs) in six cases. In all the cases of paralysis the legs were more affected than were the arms.

Manchester.

[10] Clinical Lecture, New Sydenham Society's Transactions, vol. i., 1884, p. 578.

[11] Nielson's article in New Sydenham Society's Transactions, vol. clxx., p. 237.

[12] Annales d'Hygiène, 1889, vol. xxii.

[13] At St. Denis, where 280 were affected.

CASES OF ARSENICAL PERIPHERAL NEURITIS.

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FOR the past four months I have been interested in the number of persons presenting themselves at the out-patient rooms of the Stanley Hospital on my days of attendance who exhibited symptoms of neuritis in various ways. In two cases, both those of women, there were large outbreaks of herpes zoster of the intercostal variety and in another case, that of a man, there was herpes zoster distributed from the buttock down the posterior surface of the thigh; in the cases of the females the skin of the abdomen and back was of a pale umber colour. Other patients complained particularly of peculiar pains in the hands and feet and on examination their cases were diagnosed as cases of peripheral neuritis probably due to alcohol. In the case of two patients particularly who confessed to having taken small quantities of beer, and that only at meal times, the possibility of lead as a cause was considered, but there were no special diagnostic symptoms to support it, and yet it was difficult to understand how the alcohol alone could have been the sole cause of, and could have produced, such marked symptoms, for none confessed to spirit-drinking. There is no doubt now, however, that these cases were the outcome of arsenic in the beer and I thought it would be of interest to describe briefly some of the more characteristic features noted.

CASE 1.—A married woman, aged 42 years, came complaining of pains and numbness in the hands and feet with