has persisted with remissions and relapses, and is on the whole unchanged. One of this final group has had symptoms for twelve, two for seven, three for four to five years, and two for two years. It is thus apparent that the prognosis is very good as regards life; but it is also shown that the symptoms on the whole tend to be chronic. This chronicity, when considered in conjunction with the absence of evidence of physical disease, suggests very strongly that, although there may be some slight physical basis, the nervous or functional element preponderates. It is also clear that pain of this type has no bad prognostic significance, even if the patient is suffering from an organic cardiac lesion.

Conclusions

1. A cardiac pain of an anginal nature is described, the characteristics of which enable it to be differentiated as "innocent": the term "angina innocens" is suggested.
2. The differentiation of angina innocens from other types of cardiac pain is described.
3. An account is given of a syncopal variety of the syndrome.
4. The prognosis as regards life is good, but the duration of the pain, with remissions, is often protracted.
5. Factors possibly concerned in the production of the pain are discussed.

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M. Sallick (*Ann. Surg.*, November, 1936, p. 853) has investigated the late results in seventy-four cases of acute perforated peptic ulcer treated by simple suture alone. In the majority of cases at least three years had elapsed since operation, and in no case was the post-operative period less than one year. All the patients were male, and during the last ten years it was noted that not a single case of acute perforation of peptic ulcer occurred in a female. The youngest patient was 19 and the oldest 67, the largest number of cases being in the 30-40 age period. The majority of acute perforations were found in gastric ulcers, forty-one being situated proximal to the pylorus, twenty-six lesions were in the duodenum, and seven were found at the pylorus. All the duodenal perforations were on the anterior surface or superior border of the intestine; of the stomach perforations four were through its posterior wall into the lesser cavity, and the remainder were equally divided between the lesser curvature and the anterior surface. In the series sixty-two patients (86 per cent.) had a history of typical ulcer symptoms, and diagnosis was easy in nearly every instance. Operation consisted of simple closure in three layers except for three cases, in which a single suture layer only was used. Only six cases were drained. There were eight deaths in the series, the highest mortality rate being noted in patients over 50. The mortality percentage was found to rise directly and sharply with delay in operation. Follow-up results were obtained in forty-five of the total sixty-six patients who survived operation, and it was seen that twenty-nine were found to have had further gastric trouble, a recurrence of 64 per cent. It is considered that the low mortality rate and excellent early results warrant the use of simple closure as a routine procedure in cases of acute perforation, but further medical or surgical care will be required in most instances.

PREVENTION OF DISEASE IN INDUSTRY *

BY

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Industrial medicine is the practice of medical supervision, preventive medicine, and public health within the confines of an industry. Its aim is to safeguard the health of the employee and to minimize time lost from work because of sickness or of accidents. Though one of its functions is treatment it is mainly an advisory and preventive service. The industrial medical officer has to co-operate with managers, workers, engineers, chemists, and architects. He has to discover faults in the working environment and try to find remedies. One of his most interesting duties is to bring into the effective service of industry the discoveries of the research worker.

The Factory Department of the Home Office is constantly engaged in effective and progressive work for the prevention of disease in industry. It numbers on its staff men and women who are among the greatest living authorities on different aspects of industrial hygiene and toxicology. Their profound store of knowledge, constant helpfulness, and unfailing courtesy industry sometimes fails to appreciate to the full. It is important that doctors should have the special knowledge and training which enables them to offer advice to the employer as to how his industry may be carried out in safety. At present, with a few exceptions, it is only the medical inspectors of factories who have this knowledge. No doubt with the growth of this branch of preventive medicine more doctors will make themselves competent in this interesting work.

The main principles underlying the prevention of disease in industry can be summarized under fifteen headings.

1.—Protection of the Workman by Law

In this country the number of diseases notifiable under the Factory and Workshops Acts and subject to compensation under the Workmen's Compensation Acts indicates the existence of an alert and enlightened legislature. From 1878 onwards provisions were made to control dangerous trades by so-called special rules of the Home Office. The early knowledge of industrial diseases was obtained by placing an obligation on the medical practitioner and employer to notify them to the Chief Inspector of Factories. Between 1896 and 1927 anthrax, toxic jaundice, epitheliomatous ulceration, chrome ulceration, chronic benzene poisoning, and poisoning by lead, phosphorus, arsenic, mercury, carbon bisulphide, and aniline were made notifiable. The scope of the Workmen's Compensation Acts is wider than that of the Factory Acts, as they are intended to cover all cases of sickness of strictly occupational origin, the individual being considered and not merely the conditions under which he works. There are now some thirty-eight scheduled diseases, and of these the diseases of miners and dermatitis alone constitute more than 90 per cent. of the cases compensated. New occupational risks constantly arise; asbestosis and dioxan poisoning can be quoted as dangers recently brought under control. Sometimes great expansion will occur in one trade, as was the case with the manufacture of accumulators from 1922 to 1924 owing to an increase in the use of motor cars and wireless apparatus. Such expansion of an industry makes great demands on those responsible for the prevention of disease in the factories concerned.

* Introductory remarks to a discussion on occupational diseases, Medical Society of London, March 22, 1937.

2.—Medical Inspection Under State Support

In this country medical examination of entrants into industry, required by law and carried out by certifying surgeons, is very limited in extent, and applies only to young persons between the ages of 14 and 16; but it was undoubtedly the forerunner of the much more extensive voluntary medical examination now frequently undertaken. An increasing number of employers are realizing the advantages of some kind of medical service in the factory. An additional measure of protection applied in many industries is the periodic medical examination of any workers exposed to known risks. This may be at weekly, fortnightly, monthly, or quarterly intervals, and may be carried out by the certifying surgeon or an appointed surgeon approved by the Chief Inspector. These examinations are chiefly undertaken in the case of work involving exposure to lead, to carbon bisulphide, to benzene and other fumes in india-rubber works, and to chromic acid in chromium plating. After the war a number of medical men were appointed to work as whole- or part-time works doctors, with happy results, but there is a need for the employment of a still greater number. They can often detect intoxication before disability is produced. Thus examination of the blood for punctate basophilia is of extreme value in the prophylaxis of plumbism, and is indeed essential if the occurrence of manifest plumbism is to be avoided. Similarly, in the earliest stages of benzene poisoning the platelet count and white cell count may fall, and before tetrachlorethane poisoning appears elevation of the white cell count may be found. Facilities should be available for periodic medical examination and for repeated radiographs of the lungs in persons exposed to the risk of pneumoconiosis.

3.—Prevention of Dust and Fume

Dangers from dust and fume may be removed by the application of local or general exhaust ventilation. As Sir Thomas Legge emphasized, "unless and until the employer has done everything—and everything means a good deal—the workman can do nothing to protect himself, although he is naturally willing enough to do his share." Wherever possible exhaust ventilation through hoods must be applied at the point of origin of the dust or fume. It is in use in the manufacture of electric accumulators and of white lead, in the manipulation of silica and asbestos, and of carbon bisulphide and benzene in india-rubber works. In certain instances general as opposed to local exhaust ventilation is applied. Good examples of this are the ventilation of dope rooms and of cellulose-spraying shops, where it is obviously impracticable to apply local exhausts direct to each doping bench or spraying horse. In dusty lead processes, such as mixing and pasting in the manufacture of electric accumulators, and the breaking down of the white-lead stack, the hose-pipe must be freely used to reduce dust to a minimum. The breaking down of white-lead stacks in a dry state must be forbidden, and white lead should be converted direct into an oily pulp without dry grinding. The use of dry sandpaper for the removal of paint must be forbidden, and wet waterproofed sandpaper must be substituted. A preventive method which has been widely applied in the mining, metallurgical, and ceramic industries is the substitution of wet methods for the original dry screening, grinding, milling, and mining processes. Dry drilling is the cause of most of the dustiness in mining, and, while wet drilling does not ensure a dust-free atmosphere, it reduces dustiness very considerably. In the grinding industries where sandstone wheels are used there should

be a continuous stream of water running over them. In dusty trades respirators should be used where possible, but it is usually difficult to get the men to wear them.

4.—Protective Apparatus Uncontrollable by the Workman

Sir Thomas Legge used to emphasize that in the prevention of disease in industry, "if you can bring an influence to bear external to the workman—that is, one over which he can exercise no control—you will be successful; and if you cannot or do not you will never be wholly successful." In the case of exhaust ventilation it is usually a simple matter to have the machinery operating the fans outside the workshop altogether. Even so, the protective apparatus may not be fool-proof, as in the case of the workman in a grinding shop who can turn back the hood from his grinding wheel, for use as a receptacle for tools, thus making the whole apparatus ineffective.

5.—Education of Workman as to Nature of Danger

Sir Thomas Legge used to insist that "all workmen should be told something of the danger of the material with which they come into contact, and not be left to find it out for themselves, sometimes at the cost of their lives." The factory physician should insist on the necessity of teaching the workman to take an interest in protecting himself. He should be taught the importance of clean habits in lead works, and should be made to understand such things as the principles of dust suppression. For example, he should know that a vacuum cleaner is used to remove dust from a workshop for his protection, and should therefore never be employed with the motor reversed. Cautionary placards and illustrated notices should be used in the workrooms concerned so that the early lesions of the skin in anthrax and in chrome ulceration are familiar to all. To ensure the prompt treatment of anthrax an individual card has been devised for workers employed in industries exposing them to risk. In case of illness this is presented to the doctor as a hint that the possibility of anthrax should be considered. It is of vital importance to train men in safe methods of artificial respiration so that these can be employed promptly in cases of carbon monoxide poisoning. The factory physician must never agree to a scheme where the workmen are kept ignorant of the poisonous nature of substances handled. In the war American workmen were told that trinitrotoluene might indeed explode, but was otherwise harmless. This attitude was a distressing obstacle to those who tried to introduce into American plants the safeguards which had been successfully adopted in this country.

6.—Cleanliness of Work Places

In some dangerous trades constant vigilance by a staff of good foremen is necessary. In the manufacture of trinitrotoluene absorption through the skin cannot be prevented unless benches, tools, floors, and walls are kept spotlessly clean. Similarly, glaze rooms and dipping rooms in the potteries, accumulator pasting shops, and all rooms in which a dusty lead process is carried on must be wet-cleaned every night to prevent the inhalation of dust of compounds of lead. Where it is impracticable to use a wet process—as, for example, in the manufacture of litharge—the foremen must see that no dust is raised in shovelling.

7.—Bodily Cleanliness

Cloakrooms, washing rooms, messrooms, baths, nail-brushes, towels, and soap must be provided by the employers and used in their time. Where absorption is known to occur through the skin, as in the use of aniline,

nitrobenzene, and trinitrotoluene, appropriate protective clothing must be worn. If direct contact with the poison cannot be avoided every means must be adopted to protect the skin. The surface which is necessarily exposed may be covered with a bland ointment, dusted with powder, or washed frequently. There is a risk in too much washing of the skin, and care must be taken in such cases to use the least irritating cleansers, to avoid scrubbing, and to replace the lost oils of the skin by inunction with an animal fat.

8.—General Hygiene

There are certain principles which apply to all trades but are of greater importance in the dangerous trades, because to neglect them may increase the susceptibility of the worker to the poisons concerned. Measures must be taken to prevent long hours of work, the employment of boys and girls, undue heat from furnaces and steam from tanks, and the use of underground workshops and bad lighting and ventilation. In this country the law requires that every factory and workshop shall be kept clean and free from effluvia, provided with sufficient means of ventilation, and kept at a reasonable temperature. It does not, however, contain any provisions as regards lighting. If domestic conditions were always of the standard required by law for a factory or workshop the health of the general population would certainly be improved. It is not suggested that the conditions existing in every factory or workshop in this country are by any means perfect, but in the majority a good standard has been attained. During the war it was realized that hygienic surroundings, good ventilation and lighting, facilities for obtaining food at a reasonable cost, and opportunity for rest and recreation were not only good for the worker but to the advantage of the employer. The benefits derived from such improvements have served to stimulate the provision of further facilities for workers to enjoy a healthy life. Except in the special rooms set aside for the purpose, smoking, eating, and drinking must be forbidden in certain works—for example, lead works. Otherwise a man might carry a compound of lead on his fingers to his cigarette and perhaps inhale a dangerous amount.

9.—Improvements by Chemists

The simplest method of preventing an industrial disease is to prohibit the use of the toxic substance which causes it. The possibility of such prohibition depends on the finding of an innocuous substance competent to replace the noxious one. In the case of yellow phosphorus, workers in the match industry were completely protected by the introduction of a harmless substitute in phosphorus sesquisulphide. The substitution of silver salts for mercury for the silvering of mirrors provides another example of the introduction of a harmless substance in place of a harmful one. Chemists have produced a low solubility glaze which protects the potter from the dust of white lead, and in a similar way paint technologists have protected the painter of metals by the invention of a non-setting red lead. The use of plastic rubber—that is, rubber in which litharge has been incorporated in a mother batch to the extent of 90 per cent.—will abolish the production of lead dust in certain processes in the rubber industry. Extraction with sulphuric acid or oxidation will reduce or completely remove the carcinogenic activity of a mineral oil such as that used in cotton mule-spinning. Substitutes must be found for toxic solvents. Since coal-tar benzene is a highly toxic substance, the works chemist must choose less toxic solvents—for example, petroleum benzene,

naphtha, and acetone. Further work is required to find, for example, a harmless substitute for nitrate of mercury in the felting of fur.

10.—Improvements by Engineers

Wherever possible mechanical means should be substituted for hand carriage. Examples of this are seen in the use of cranes, rails, hoists, travelling belts, covered conveyors and hoppers, and automatic packing machinery. The abolition of hand-filling of shells, the substitution of shot-blasting for sand-blasting and of stainless steel for chromium plating, and the use of a closed-in film steam evaporator in the manufacture of silver nitrate are further examples. The invention of electroplating about 1840 led to a great diminution in the number of cases of mercury poisoning, because it replaced water-gilding, in which mercury was volatilized from an amalgam by heat over a fire. An outstanding contribution to the reduction of the risk of lead poisoning was the invention of the wet-pulping method in the manufacture of white lead; 50 per cent. of the white lead manufactured in this country is never handled in the dry state, but is converted from an aqueous pulp to an oily paste in closed-in machines. Glass-workers' cataract has been minimized by the invention of a glass-bottle-making machine producing bottles at the rate of forty a minute, and at one-ninth the original labour cost. In iron and steel rolling mills the use of goggles made of Crookes's glass protects the eyes from the fierce heat and glare, and so prevents cataract.

11. Knowledge as to Portals of Entry of Toxic Substances

Where it is known by what route—respiratory, alimentary, or cutaneous—a poison is absorbed the physician can, in consultation with the employer, indicate on what principles the methods of protection should be based. In the majority of industries absorption through the respiratory tract is of overwhelming importance. Except very rarely lead poisoning is not due to eating with unwashed hands. In a few industries absorption through the skin may take place—for example, in the handling of aniline, nitrobenzene, trinitrotoluene, nicotine, and lead tetra-ethyl. The mechanical details which render the workers in a given industry safe from toxic substances must be settled in consultation with engineers.

12.—Multiplicity of Poisons in a Given Trade

A given trade may be dangerous for more than one reason. For example, in the painter's trade, lead, turpentine, benzene, and methyl alcohol may all be used, and in the rubber trade benzene, lead, and carbon bisulphide. In the leather trade there may be exposure to anthrax bacilli and to carbon dioxide, sulphuretted hydrogen, nitrobenzene, and aniline. A workman may be ignorant of the substances used or they may be trade secrets. In taking a clinical history, even when the substances are known, it is often difficult to determine which is responsible. The doctor must discover the particular department in which a man works. For example, in the rubber trade where plastic rubber is not used there is a risk of lead poisoning, but it only occurs in the mixing room, where oxides of lead are handled. In complicated processes, such as those of dye manufacture, many difficulties may be encountered in an attempt to determine which chemical compound is the responsible agent. Such is the case with the so-called aniline tumours of the bladder.

13.—Limitation of Exposure

In certain dangerous processes it must be forbidden for men to stay for long periods at any one job. In lead

smelting and in processes involving exposure to carbon bisulphide, nitrobenzene, and trinitrotoluene short shifts must be enforced. Hours of work must be limited for men working in compressed air or in hot deep mines. The factory physician must make use of all known methods to detect the earliest onset of poisoning by substances such as lead, benzene, and tetrachlorethane.

14.—Selection of Immune Persons

Employment of women and of all persons under the age of 18 in certain lead trades must be forbidden. In gasworks and on blast furnaces, where there is a danger of carbon monoxide poisoning, it is better to employ middle-aged men, who are partially protected by their lesser physical activity and slower respiration. The selection and employment of only immune persons is an ideal the attainment of which must wait on better knowledge. If research could produce satisfactory tests for immunity to various poisons a great deal of suffering and expense could automatically be abolished.

15.—Further Researches

It would be idle to suppose that our knowledge of industrial diseases is a finished chapter. Many diseases of occupational origin remain unknown for years, notable instances being asbestosis and Weil's disease. Clearly there must be others still eluding our search. New processes are constantly springing up. In some countries new solvents for quick-drying paints and varnishes have been allowed to poison men, whereas they should have been first tested on experimental animals. A new method of tin refining recently produced outbreaks of arseniuretted hydrogen poisoning under circumstances which should have been condemned beforehand by chemists, since it is known that the action of water on metallic arsenides is to set free this deadly gas. Until 1933 the co-operation of geologists in attacking the problem of pneumoconiosis had not been sought. The petrological microscope rapidly incriminated silicates such as sericite and sillimanite, whereas previously silica had been held solely responsible. Recently fluorosis of bones, a new horror of industrial medicine, was unearthed. Is this condition widespread among cryolite crushers elsewhere than in Denmark? Do bath enamellers suffer from it? What, if any, will be the ultimate consequences to bone and bone marrow of the deposition of calcium fluoride in the skeleton? Is the high incidence of malignant disease of the nasal sinuses in workers in nickel related to substances used in their work, and is there also a high incidence of lung carcinoma among them? Will the chemist find a suitable substitute for nitrate of mercury in the felting of fur? Will the bacteriologist succeed in producing effective inoculation against Weil's disease? What is to be done about Raynaud's phenomenon, produced by the use of vibrating tools, including pneumatic drills, rams, chisels, and riveting machines? Will the phenomenon, hitherto confined to women, become equally common in men? These and many other problems await solution. We are on the right path, but we have a long way to go.

The King Edward's Hospital Fund for London has made arrangements for Coronation tours of royal palaces and other historical buildings famous throughout the Empire. These privileged visits will take place on April 7, 10, 14, 21, and 28; May 19 and 28. Tickets are 10s. each or £2 10s. for the series, and the entire proceeds are devoted to the Fund. Communications should be addressed to the secretary, King Edward's Hospital Fund for London, 10, Old Jewry, E.C.2.

EPIDEMIC CATARRHAL JAUNDICE IN SCHOOL CHILDREN

BY

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Towards the end of 1936 an outbreak of jaundice occurred in Leicestershire, the villages of Newbold Verdon, Desford, and Syston being chiefly affected. The epidemic was mild and no deaths resulted. Altogether forty school children suffered from the disease, and it is estimated that this figure represents 60 to 70 per cent. of the total number of cases, pre-school children and young adults being also affected.

The first intimation of the outbreak came from Newbold Verdon, when the head teacher of the local school reported in November that five children were absent suffering from jaundice. It was decided that I should undertake a special investigation in order to ascertain whether or not the disease was caused by the *Leptospira icterohaemorrhagiae*.

Nomenclature

Epidemics of jaundice have been recorded since ancient times and have occurred at one time or another in every part of the world. No attempt at classification was made until Weil (1886) published an account of the symptoms in a number of severe cases.

Map showing the relative position of the villages where cases of epidemic catarrhal jaundice occurred.

Cockayne (1912) went a step further and differentiated between Weil's disease and the milder type by styling the former "infectious jaundice" and the latter "epidemic catarrhal jaundice." This classification was commonly used until Hurst and Simpson (1934) produced definite evidence that there were in reality two forms of the milder jaundice, and distinguished the infective hepatic type from the epidemic catarrhal.

In November, 1914, Inada and Ido discovered that the organism responsible for Weil's disease or infectious jaun-