and that this figure varies with the nature of the disease, being affected specially by the extent to which the glomeruli may have suffered. The variations are, however, also related to anatomical and physiological defects of the pelvis, ureters and bladder, and any considerable hold up of urine by an obstruction will clearly affect the hourly amount of drug available for estimation. Neither of these latter procedures, namely, observations of specific gravity or chemical estimations, will, of course, show the difference of function between the two kidneys. As it is just this discrimination which is so essential in urology, it will be realised that as a measure of function in disease, excretion urography is not a perfect method, for when using it we must depend for this information upon the shadows cast by it, and these may be difficult to interpret, and it will not, therefore, replace the standard and accurate tests carried out with the cystoscope, namely, that of investigating the specimens of urine obtained from each kidney through ureteric catheters and estimating the percentage of urea in them, nor does it necessarily enable us to dispense with infiltration (cystoscopic) pyelography. In some cases it certainly indicates disturbances of renal functions more easily than does the excretion of indigo carmine observed through a cystoscope, as it colours the ureteric effluxes.

FRESH LIGHT ON URINARY MECHANISMS

One of the most interesting results brought about by this new method of investigation is the fresh light that is shed upon the neuromuscular mechanisms of the urinary tract. Therefore it will help us much in the study of the pathology and treatment of hydronephrosis. This disease is the result of a defect in this mechanism; the law which governs the working of a system of unstriped muscle has broken down, contraction occurs in one segment, but no relaxation in the segment below, probably owing to the disturbance of sympathetic control. The early result of this is a colicky pain, and the later result is distention of the viscus above the offending segment, distension, but not necessarily complete atrophy, of the muscle fibres. This is a most important fact, for upon it depends the success of any operation designed to reconstruct a damaged renal pelvis; instead of adopting the simpler, and, it should be added, according to some authorities the sounder, expedient of nephrectomy. A pyelogram demonstrates clearly a hydronephrosis. Excretion urography sometimes shows the same hydronephrosis but of considerably larger size. This is because in the latter case the kidney has filled the pelvis at a rate to which it is accustomed, whereas in instrumental pyelography the opaque fluid has been run in through the ureteric catheter much more rapidly, and the pelvis has resisted the process. This gives us a clear proof that, though damaged, the pelvic neuromuscular mechanism is not destroyed; and this is an encouragement to the surgeon who wishes to perform upon it a plastic operation. It may be mentioned that this recovery of tone is easily demonstrated in another manner, namely, by draining a hydronephrosis for a few weeks by a nephrostomy; under these conditions it contracts down to a more normal size, just as a bladder distended by an obstruction below contracts down after cystostomy is performed.

The physiology of the pelvis and ureters in a normal subject, though perfectly demonstrated by this method of excretion of contrast substances, requires much study. It is easy to recognise obstruction, because these contrast substances accumulate above it, but in health the drug is quickly swept along in the urine, the calyces are not all full at the same moment, the waves of contraction passing down the ureters cause some segments to be full whilst others are empty, so that the faint shadows are only apparent in a first-class radiogram; and this must be

examined very carefully, and with the help of the best form of illumination. The early photographic films are the most suited for this, as later gas accumulates in the intestine and often makes the reading of them very difficult. But already the process is so well established that one may reasonably hope before long to see this study still further advanced by the cinematograph, and above all, by the method of retarded cinema-photography. When this is achieved we shall begin to understand the dynamics of the urinary tract in health and disease.

There are certain conditions in which excretion urography is of special value for other reasons, namely, when it is undesirable or impossible to pass the cystoscope, as, for example, in the presence of a urethral stricture or an enlarged prostate, or severe cystitis. And, again, in circumstances preventing the passage of a ureteric catheter, such as a ureteric kink, or a ureteric calculus. Many other similar surgical conditions might be mentioned, for its striking use in urinary tuberculosis is only one of them. Pyelitis of pregnancy and ectopic kidney are other examples. These are special and important uses, but of less general interest.

We must regard excretion urography first and foremost as a means for the study of the urinary tract as a whole in a manner hitherto impossible. There is no need to claim that it has made unnecessary the standard methods of investigating the urinary tract, or even that it has supplanted pyelography, for this still retains its special value of demonstrating anatomical deformities with unrivalled clearness, and is often usefully combined with the newer method of obtaining shadow photographs. Indeed, excretion urography should not be considered a rival, but rather as a supremely valuable ally.

BURNS AND SCALDS*

BY

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Deaths from burns and scalds are in this country the subject of a coroner's inquest and, consequently, it may be assumed that the Registrar-General's figures give an accurate picture of the mortality from these accidents. Changing social conditions have done much to diminish the frequency of burns and scalds, and particular mention must be made of the Children's Act of 1908, alterations in lighting, better housing and the trend towards smaller families. Fatalities are certainly diminishing but it must be realised that they still average nearly 1700 per annum in England and Wales.

Burns and scalds are classed together because their lesions are similar but it is a matter of general observation that scalds are a good deal commoner than burns. Donald² analysed the London Hospital's figures for the last thirty years and found that the percentage of scalds in the total number of deaths from the combined causes shows a tendency to increase and is now in the neighbourhood of 70. We are thus still faced with a considerable death roll which no doubt is largely made up of young children. Although legislation and social improvements may continue to restrict the number of burns it seems likely that the wastage of child life from scalds will continue so long as the teapot and kettle exert their fascination on youthful minds.

Burns and scalds have always been looked upon as dangerous accidents but it must have surprised many to

* Read in opening a discussion in the Section of Surgery at the Annual Meeting of the British Medical Association, Eastbourne, 1931.

learn from Fraser's Edinburgh series published in 1926 that the mortality was 38.7 per cent. in children under 10 years old admitted to hospital. Prognosis depends upon the area burned and the age of the patient more than upon the depth of the burns. Involvement of 12 per cent. of the body surface may end fatally but an even smaller area has caused death in the very young.

The immediate effect of a burn is to produce shock and this may be the direct cause of death. The clinical picture in no way differs from shock due to other causes, and its effects are due to stagnation of blood in the capillary system throughout the body and a consequent profound fall in blood pressure such as occurs in fainting. When death follows it is consequently death from a physical mechanism. The stage of shock lasts for a variable time and is sometimes surprisingly slight after severe injuries. In the course of some hours, or it may be a day or two, the patient who survives enters a state of toxæmia or else passes on to recovery.

Toxæmia may follow with quite dramatic suddenness at a time when things seem to be going well. The temperature rises to perhaps 104° , the pulse frequency is increased, restlessness supervenes and passes into unconsciousness and death. It has been shown by experiment that this remarkable condition depends upon absorption of certain poisonous substances from the burned area. These substances are protein and amongst them is histamine. Death from toxæmia is consequently death from a chemical mechanism in contradistinction to the physical process which brings about death in the stage of primary shock. These facts must be remembered when we come to treat the two conditions.

GENERAL TREATMENT

The immediate treatment of a burn or scald is the treatment of shock, and attention should thus be focused from the outset on the general condition of the patient. Occasionally it may be wise to postpone removal from the scene of the accident for a few hours, and in such instances morphine hypodermically and fluids by the mouth should be generously given. More often the patient can safely be moved to a hospital or institution and this should be carried out with a minimum of attention to the burned area. Anything that can be done to it under emergency conditions is likely to increase shock and the best routine course is to withhold all dressings. In particular the popular linseed and carron oils should be avoided. A burned patient demands so much medical and nursing care that home conditions are rarely ideal for the treatment of such a case. His prime needs an hour or two after the injury are rest, warmth, fluids and morphine. These should all be supplied as soon as possible and two or three hours may often be advantageously spent in this way before attending to the burns. During this time the patient is given a chance to contend with shock and by making haste slowly he will sometimes avoid disaster.

LOCAL TREATMENT

Many different applications have been used in the local treatment of burns, but the introduction of a 2½ per cent. aqueous solution of tannic acid by Davidson of the Henry Ford Hospital, Detroit, in 1925 marks an important step forward.

It was known that the dangerous condition of toxæmia was due to the formation of autolytic products of protein decomposition in the burned area and their subsequent entrance into the blood stream. Tannic acid does what the much-used picric acid tries to do, that is to say it coagulates the damaged proteins and prevents their absorption into the circulatory system. In consequence, the constitutional disturbances are minimized, pain is

strikingly lessened and scarring is generally slight. Most important of all, there seems good reason to believe that the mortality is greatly reduced. Details of the method and its results have been fully described by E. C. Davidson¹ and later by W. C. Wilson.² It will be sufficient here to give a brief outline of its practical application.

As soon as the patient has made some recovery from the initial shock he is anaesthetized with gas and oxygen and the burned area carefully swabbed with ether. Dead and damaged tissue is snipped away with scissors, vesicles are opened and their outer wall removed. A flat, clean surface is thus produced and tannic acid is applied in 2½ per cent. freshly prepared aqueous solution with an ordinary throat spray.

The whole area except the face is thus treated and the patient put back to bed under electric lamps with no other dressing on the burns. The spraying is repeated hourly seven or eight times until the burned area is tanned dark brown. Meanwhile, such toxins as have already entered the system are diluted by copious fluids given by the mouth, rectum, subcutaneously or intravenously.

Subsequent Course after Tannic Acid Treatment

Under this treatment fever and pain subside, the dangerous toxins are locked in a coagulum and the general comfort and well-being of the patient is often remarkable.

If treatment is applied soon after the accident and the toilet has been efficiently performed there may be no sepsis. Sometimes, however, pus forms underneath the scab and fever reappears. Under such conditions there is a temptation to resort to fomentations or other moist dressings. These are harmful because they release the toxins from the inert coagulum and re-establish the condition of toxæmia which we most want to avoid. The proper treatment at this stage is to liberate the pent-up fluid by cutting channels in the coagulum with pointed scissors and so providing mechanical drainage without moistening the scab. During this time the patient remains beneath the electric light cradle which dries up discharge and maintains body heat.

In about two weeks the coagulum spontaneously separates though it takes longer when the burns are deep. Beneath will be found healthy epithelium or granulation tissue. The latter may be dressed with flavine (1:1000) in paraffin or with sterile vaseline, since the danger of toxæmia has been removed with the coagulum.

BLOOD TRANSFUSION

Before the introduction of tannic acid one has seen a timely blood transfusion apparently save life. Robertson of Toronto obtained splendid results by his method of exsanguination-transfusion in which the patient was bled immediately before receiving the transfusion. Though both these methods aim at the dilution of circulating toxins, exsanguination first removes a large amount of toxin and then dilutes the remainder by the blood transfusion.

Prevention is better than cure and it seems reasonable to imagine that if toxæmia can be prevented there will be no need for blood transfusion. Such indeed has been my experience with tannic acid and though there are still occasions—(e.g. in well-established toxæmia) when blood transfusion is a valuable auxiliary method of treatment in burns and scalds, yet nowadays one rarely finds it necessary.

DEFORMITY AND DISFIGUREMENT

I have said nothing of the deformities and disfigurements which these accidents leave in their wake. Some of my audience may come from industrial areas where their daily round brings them in contact with such cases, and others may recollect unfortunate naval ratings burned

by cordite. My own work in this field of surgery has largely concerned the young and I should like before concluding to touch briefly on this aspect of the matter.

The pictures I show are merely illustrations of the fascinating sideline which we call plastic surgery, a branch of our art which owes much to the patience and skill of Sir Harold Gillies. Opportunities are considerable even though the difficulties in small patients are greater than in adults. Moreover, it is possible that tannic acid will increase their number in much the same way as the introduction of diphtheria antitoxin increased the frequency of post-diphtheritic paralysis by saving the lives of many severely stricken children who would otherwise have died.

CONCLUSION

In conclusion, I return to our main theme and you will have gathered from my preceding remarks that I regard the introduction of tannic acid as an important event. Perhaps in the past there has been a tendency to forget the excellent adage that we must treat the patient and not the disease. The general treatment of the burned and scalded will always remain of paramount importance and I have failed signally in my task if I have not brought this home to you. It does, however, seem from our growing experience with tannic acid that we have in it a substance which treats both disease and patient inasmuch as it forms a local application of first-rate efficacy and, when applied early, goes far towards preventing the onset of those calamitous symptoms which we call toxæmia.

Time has not permitted me to cover the whole ground and though I am highly conscious of the honour of being allowed to open this discussion, I am very well aware that much remains to be said. In particular, I hope to hear from subsequent speakers whether they find it possible to treat these patients in their private homes; to what extent those who have used tannic acid find sepsis difficult to combat, and how far they use it successfully in late cases as well as early.

REFERENCES

- ¹ Davidson, E. C.: *Surgery, Gynecology and Obstetrics*, 1925, XLI, 202.
- ² Donald, C.: *Lancet*, 1930, II, 949.
- ³ Wilson, W. C.: *Tannic Acid Treatment of Burns*. Medical Research Council, 1929 (H. M. Stationery Office, 1/-).

INDUSTRIAL PROBLEMS FROM THE STANDPOINT OF GENERAL PRACTICE *

BY

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The practice of Industrial Medicine is not limited to the problem of occupational diseases. Its frontiers include within them a large area of clinical study common alike to it and to general practice. In order, however, to appreciate these common interests to the full and to devise suitable methods of investigation and study it is necessary to consider not only industrial processes but to an even greater extent to review the whole phenomenon of modern industrialism and the effects which this strange new growth has had, and is having, on the population as a whole. Only in this way can certain otherwise obscure factors be properly evaluated. If the remarks which follow appear in places to be somewhat in the nature of digres-

sions I must ask indulgence for an attempt to outline what I believe to be some important etiological agents in the clinical problems which confront the general practitioner in dealing with industrial incapacity.

Human evolution is the resultant of a continual battle between emerging biological factors and environmental conditions. No history of man; no study of his successes or failures, his health or disease, his hopes or his fears or his mental or physical attributes can be of any value if it ignores the evolutionary value of environment. There have been phases in which the conditions of life have remained more or less constant for long periods, and during these man has been able to adjust himself gradually and on the whole successfully; there have been other phases in which rapid alterations have taken place to which groups of humanity, both large and small, have either failed to adapt or have done so with an inadequate measure of success.

In the last 200 years a wholly new phenomenon has appeared. Man has entered the age of applied science in which for the first time he has deliberately set out not so much to adapt himself to changing environment but by means of his acquired knowledge to modify environment to suit himself. This constitutes an epoch-making break with the past, and the present industrial age is but a stage of this new development. In a bare 150 years man has so changed the face of Western Europe that today in this country over 80% of the population are town dwellers removed from the necessity of direct struggle with nature, relying for their living on industry and commerce and comparatively unmindful of the precariousness and essential instability of their position. Thus the population of Britain is almost entirely dependent on the smooth functioning of a still immature economic system. It is not only surrounded by a mechanised environment of an entirely novel kind but inherited racial memories form no reserve of experience on which man can draw for support in times of difficulty, since biologically the time available for adaptation to new circumstances has in many respects been inadequate as yet to permit of the necessary mental and physical adjustments.

Health, mental and physical, is the measure of successful adaptation to environment and it is therefore less dependent on pathological hazards than we have hitherto been led to believe. Once we get outside the individual, and begin to study the external forces at work on him, we see how important it is to form clear impressions of mental processes; and we see, too, how very subservient physical conditions are to the influences of the mind by means of which alone full personal adaptation can be attained.

When the science of medicine began to supplant the practice of magic its first concern was the body of the sufferer; later the study of community health led to the formation of the public health service which was until recently concerned almost exclusively with physical conditions. As an offshoot of public health administration there has arisen the subsidiary branch of industrial medicine which, by studying and improving the hygiene of factories, workshops and industrial processes, has conferred a great measure of increased health and happiness.

These services are indispensable for the health and well-being of the community and the progress of the past few years must not only be encouraged but in many spheres advances must be accelerated, though the possibility of success along traditional lines is definite and in fact limited, since the psychological factors at work in the community far transcend the purely physical.

The general practitioner has watched official public health activities with much interest even if at times he

* Read in opening a discussion in the Section of Public Health (including Tuberculosis and Occupation Diseases) at the Annual Meeting of the British Medical Association, Eastbourne, 1931.