creatinine from the concentrated urine in the tubules back into the blood. The renal damage described above is probably not due mainly to *reduction in glomerular filtration rate*, because oliguria from this cause is associated with very high creatinine and low chloride concentration in the urine, whereas in these experiments the creatinine concentrations are low and the chlorides may be increased. Microscopically the damaged organ appears fairly vascular.

Blockage of the tubules, suggested as a possible factor by the appearance of the deposit in them, should produce a tense kidney, in contrast with the striking flaccidity observed in these damaged kidneys. The deposit does not appear compact enough, nor does it occur in a sufficiently high proportion of tubules, to lead one to expect that it could reduce the creatinine output to one-quarter. A more likely hypothesis would involve release of a *poison* from the damaged limbs that affects the *tubule cells* by increasing their permeability to creatinine, urea, and other substances which are concentrated by the kidney. These substances would diffuse from the concentrated solution in the distal parts of the tubules across the tubule walls to the blood in the venules. Hastening the flow of liquid down the tubules with diuretics should reduce the loss by leakage of creatinine and so increase the creatinine clearance, an expectation which accords with observation. The main objection to regarding this as a self-sufficient hypothesis is that poisons such as cyanide or mercury salts produce an increased urine flow, due to inhibition of water reabsorption, before they produce the anuria due to increased permeability. Correspondingly, organs poisoned in this way are usually tense. This is, however, not an insuperable objection to the view that the poison here in question affects the permeability mainly.

Such a poison might reach the tubule cells either from the blood stream or, if diffusible, from the lumen of the tubule. In the latter event the poison itself might well be a substance which is concentrated in the tubules, and act the more potently in virtue of its concentration. This possibility has, however, been excluded in the following way. Partial obstruction of one kidney by an increase of ureter pressure resulted in a fourfold concentration of urine (as evidenced by creatinine-U/P ratio) compared with the unobstructed side. If the toxic agent released from the limbs had been similarly more concentrated on the obstructed side the severity of the damage should have been greater on that side. In fact, the obstructed side, after removal of the obstruction, was, if anything, a little less severely damaged than the unobstructed side.

So far as available evidence goes, the injury to the kidneys in our series of dogs appears to be of the same kind as that in man after comparable prolonged crush injury to the limbs. The essential nature of the renal damage has not yet been determined, but the evidence suggests that the main factor may be concerned with increase in permeability of the renal tubules due to a toxic agent released from the damaged limbs, while there may be an additional factor involving reduction in the rate of glomerular filtration probably due to lowering of glomerular capillary pressure.

VARIATIONS IN THE RESPIRATORY RHYTHM OF PROGNOSTIC SIGNIFICANCE IN MALIGNANT HYPERTENSION

BY

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Recently I drew attention to variations in the respiratory rhythm in a case of malignant hypertension in its terminal stages (Gunewardene, 1938). A similar type of respiration has been noticed in cases of meningitis (Hutchison and Hunter, 1929). The characteristic feature is that the respirations are grouped; in each group the initial excursion in the tracing is the largest, the subsequent ones getting smaller, until the movements cease for a moment. This means that the depth of the respiration gradually declines as in the waning phase of Cheyne-Stokes respiration. In that case, however, there was no period of apnoea.

This type of respiration is seen in the terminal stage of malignant hypertension when pronounced albuminuria, persistent hypertension, and extensive eye changes (haemorrhages, exudates, cotton-wool patches, oedema of the disks, etc.) are present. The patient is generally quiet and lies flat on the back without a suggestion of the breathlessness of the cardiac type which previously had been well marked. A little restlessness, not continuous, is often observed; he opens his mouth frequently and breathes as though he is yawning half-heartedly. Occasionally he is irrational. Sometimes there is maniacal excitement; at other times a little drowsiness suggestive of a uraemic state. Uraemic twitching or convulsions were not observed.

These variations in the respiratory rhythm in association with malignant hypertension have not been described before, so far as I can gather from the literature available in Ceylon. Their cause has yet to be explained. Are they due to cerebral oedema, or to the effects of toxins on the respiratory centre? Is the alteration in the chemistry of the blood responsible for them? Eyster has shown that Cheyne-Stokes breathing can be produced in dogs by a rise and fall of the blood pressure in the presence of raised intracranial pressure.

In the following case, grouping of respiratory movements similar to those in the case referred to above was noticed, but each group was followed by a period of apnoea. The tracing is unlike Biot's type, but resembles that of Cheyne-Stokes respiration with the waxing phase absent. The rhythm is irregular and the depth of the respirations varies.

Case Report

The patient, a male sedentary clerical worker aged 42, was admitted on March 7, 1939, complaining of occasional occipital headache, giddiness on and off, and blurring of vision. He was lying quiet, but a few days previously he had been very dyspnoeic. Examination revealed the following characteristics. Heart: heaving apex beat—in fifth space, midclavicular line; second aortic ++; no murmurs. The lungs were clear. Blood pressure: systolic 300, diastolic 180. The brachial and radial

arteries did not feel much thickened, nor did palpation suggest such high pressure. Pulse 78, regular. Urine: scanty; S.G. 1010; albumin 0.7%; no sugar. Fundi showed oedema of the disks; flame-shaped haemorrhages, exudates, thickened arteries, very congested veins. Blood urea, 224 mg. per 100 c.cm.; urea clearance, mean 7.26% normal.

Treatment consisted of venesection; administration of sodium nitrite, theominal, etc.

During his stay in hospital the blood pressure varied between 210/140 and 260/170 (not eliminating effects of drugs). He became somewhat irrational, yawned half-heartedly, and later became a little drowsy and quiet. Just before his death (under ayurvedic treatment) on April 7, 1939, he complained that he "couldn't breathe." The accompanying illustration shows the respiratory tracing (thoracic) of this case.

According to Harrison (1939), the carbon dioxide tension in malignant hypertension is abnormally low and patients with periodic breathing have arterial blood which is under-ventilated as regards oxygen and over-ventilated as regards carbon dioxide. It has also been shown that the administration of carbon dioxide abolishes periodic breathing. The fairly sudden transition of a dyspnoeic, sometimes orthopnoeic, patient into a condition of tranquillity would suggest that changes in the chemical constituents of the blood gases and the tissue fluids play a significant part in the production of periodic breathing and the cessation of dyspnoea.

Summary

A form of variation in the respiratory rhythm associated with malignant hypertension is described.

There are changes in the periodicity as well as the depth of the respiratory movements.

These changes are of grave prognostic significance even when the patient does not look seriously ill, the duration of life in the cases described being not more than 6 weeks after their onset.

I gratefully acknowledge the co-operation of Dr. J. R. Blaze and Dr. Cyril F. Fernando, under whose care the patient was; also the kind services of the Physiological Department, Ceylon Medical College.

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VACCINATION IN GLASGOW DOCKS

BY

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The following is an account of an investigation into the potency of vaccine lymph and the effect of vaccination on the sickness and industrial accident rates among Glasgow dock workers.

As a result of small-pox of a severe type occurring in Glasgow, the medical officer of health, on June 29, 1942, issued an appeal for mass vaccination of the city's population. Since the disease had presumably entered through the Port it was felt that every endeavour should be made to have dock workers vaccinated at once. At all times close co-operation is maintained between the city's health services and the Port Authority (Clyde Navigation Trust), so that the drawing-up and completion of the scheme here outlined naturally fell to be dealt with by us. The scheme was approved by the medical officer of health, the Clyde Navigation Trust, and the port regional director.

Outline of Scheme

The first essential was to carry out vaccination promptly and with the minimum interference with the normal working of the harbour; secondly came the necessity of informing the dock workers of the need for vaccination; and, thirdly, conveniently situated vaccination centres had to be established in the Docks.

It was decided to utilize the existing gas-cleansing stations in each dock as vaccination centres and, on the day before the opening of the centres, to make use of a broadcasting van to explain the need for vaccination and to announce the time and place for workers to attend. This scheme answered extremely well, and over 60% of the workers in the Port of Glasgow availed themselves of the opportunity. The medical and nursing staff employed were directed to pay particular attention to the technique of vaccination as outlined by Sir Alexander Macgregor in his communication.

Result of Vaccination

Of the lymph used 95% was supplied by the Government Lymph Establishment, the remaining 5% being from other manufacturers. Our impression was that the Government lymph was somewhat more potent, although all the other varieties gave satisfactory reactions. The follow-up of many of the workers was far from easy owing to the constant changes of working shifts and the movement of gangs of dockers from one dock to another as ships arrived and departed, and we, of necessity, had to satisfy ourselves with records of 1,000 out

from the pock sometimes up to the shoulder and down to the forearm. (B) A normal vaccination pock with little or no constitutional upset. (C) An immune reaction sometimes described as the papule of immunity of Pirquet. (D) No reaction.

From the table it is evident that the lymph used was particularly potent, 84% of the cases showing severe or normal vaccinations and a further 10% an immune reaction due in practically every instance to a previous successful vaccination. The 58 cases which showed no reaction were all revaccinated, when only two showed an immune reaction.

Effects on Industry

We feared that mass vaccination would interfere with the normal work in the harbour and thus slow down the national effort, but this has not been so. In fact, less than 3% of all classes of workers were off work on account of vaccination. The maximum period of incapacity was one week, the great majority being back at work within 48 hours. Scrutiny of the sickness rate among dockers, office staff, and Clyde Trust employees for the 28 days subsequent to vaccination showed no increase over the normal rate prevailing at this time of year.

The industrial accident rate has also shown no increase above the normal, despite the fact that many crane drivers, capstanmen, and winchmen were vaccinated successfully, and were plucky enough to continue at work despite very sore arms.

Comments

A good previous vaccination scar was no guarantee of immunity. For example, one female who had five large foveated scars resulting from vaccination in infancy, and subsequently in 1921, had a very severe reaction.

Stout persons generally had much more severe local reactions than thin persons.

Elderly persons often showed severe reactions even although previously vaccinated.

Many suffered from a coryza, sometimes associated with sore throat, of about three days' duration from the 8th to the 11th day after vaccination. In no case was the coryza severe enough to cause incapacity for work.

Women reacted more severely than men in the same age groups.

We found that vaccination of the lower limbs caused much more discomfort than vaccination of the upper limbs.

Nine cases in our series showed a post-vaccinial rash; four of these were urticarial in type and associated with previous acne or scabies, three morbilliform, and two scarlatiniform. They all occurred between the 9th and the 10th day following vaccination and disappeared within 48 hours. We noted no case of papular urticaria, nor did any of the dock workers develop pustular rashes resembling small-pox. Neither did we see any case of post-vaccinial encephalitis nor any person who developed nervous symptoms following vaccination. Several cases showed a somewhat delayed local reaction to vaccination.

This investigation was made possible only by the willing co-operation of all classes of dock workers, and we wish to thank the medical officer of health, the general manager of the Clyde Navigation Trust, and the port regional director for permission to print this short review.

Table showing Results in 1,000 Cases

	A (Severe)	B (Normal)	C (Immune)	D (No Reaction)
No. of cases ..	121	719	102	58
Percentage ..	12	72	10	6

of the total vaccinated. The accompanying table shows under four headings the results we obtained. (A) Severe reaction evidenced by constitutional upset, enlarged axillary glands, fairly extensive localized reaction, with inflammation extending

The Chadwick Trustees have arranged for the following public lectures to be given on Tuesdays at 2.30 p.m.: Oct. 6, at Royal Society of Tropical Medicine, 26, Portland Place, W., Sir Leonard Hill, F.R.S., "The Interrelation of Clothing and Shortage of Fuel in Matters of Health"; Oct. 27, at Royal Sanitary Institute, 90, Buckingham Palace Road, S.W., Mr. W. T. Creswell, K.C., "The Forensic Aspects of Wartime Public Health Legislation"; Nov. 10, at London School of Hygiene and Tropical Medicine, Keppel Street, W.C., Bossom Lecture by Miss Jocelyn Adburgham, "Land Settlement—Its Sanitary and Architectural Aspects and After-war Possibilities"; Nov. 24, at Westminster Hospital Medical School, Horseferry Road, S.W., Malcolm Morris Memorial Lecture by Sir Arthur MacNalty, "The Prevention of Tuberculosis in Peace and War"; Dec. 8, at Royal Society of Tropical Medicine, Dr. W. Norwood East, "The Differentiation, Prevention, and Treatment of Anti-social Behaviour Disorders." Admission to the lectures is free, and further particulars can be had from the secretary, Chadwick Trust, 204, Abbey House, Westminster, S.W.1.