MEDICINE AND THE SEA AFFAIR.

INTRODUCTION.

BY
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THIS outline of the work of the medical service of the Royal Navy, necessarily brief from the exigencies of space, may well be prefaced with the satisfactory statement that the health of the service afloat has been excellent—better, indeed, than in times of peace. This fortunate result is due to several factors: in the first place, to the efforts of preventive medicine and hygiene, especially the improved ventilation of warships introduced shortly before the outbreak of war, a subject more fully dealt with on pp. 537-539; in the second place, to the healthy isolation of the Grand Fleet, far from the temptations of seaports; thirdly, to the minute precautions taken in drafting men from the shore dépôts to the fleet, which entail due quarantine after exposure to infectious fevers; fourthly, to lectures by the medical officers to the ships' crews dealing with personal hygiene and insisting on the results of alcoholic excess and the dangers of venereal disease; and, further, to the care taken by all officers, by keeping the men physically fit by means of exercise, and by combating in various ways the effects of monotony and relative inactivity, to maintain the high spirit of confidence in eventual success.

At the outbreak of war the medical personnel was at once expanded by the mobilization of the retired, emergency, and Volunteer Reserve medical officers, by the creation of a large number of temporary surgeons for the period of hostilities, and by the appointment of about ten consultants (two being anaesthetists), including Sir Watson Cheyne, President of the Royal College of Surgeons of England, and Sir William Macewen, Regius Professor of Surgery in Glasgow. Rather later an old type of naval medical officer, the surgeon's mate, was revived in the enrolment as surgeon-probationers R.N.V.R. of medical students who had passed the examination in anatomy and physiology, and who had begun, but not completed, their clinical work. They were placed in torpedo-boat destroyers and other small vessels which otherwise do not carry medical officers, so as to render first aid, and, as the records of the Jutland battle show, this trust was fully justified. The sections which follow have been contributed by medical officers responsible for the subjects dealt with.

MEDICINE AND CLINICAL PATHOLOGY.

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THE general methods of diagnosis and treatment are naturally the same in naval and civil hospitals, and do not, therefore, require any description. The association between clinical and laboratory work is as close as in the metropolitan hospitals with teaching schools attached, and new methods of diagnosis are thus tested and utilized to the full.

The war has thrown much additional work on the naval hospitals and has led to the extensive substitution of temporary surgeons for the regular medical staff owing to the necessity for employing the latter afloat, and during this period the increasing tendency of modern medicine towards subdivision and specialization has been reflected on the navy by the assignment of temporary surgeons with previous experience of special branches of their profession, such as ophthalmology, neurology, tuberculosis, otology and laryngology, and bacteriology, to the care of such patients and duties. Up-to-date departments for x-ray work, dentistry, massage, and electrical treatment are attached to the hospitals where the sick-berth staff are trained for the service afloat. The work of the laboratories of the large base hospitals was assisted by the utilization of men with scientific knowledge but without medical qualifications, and the Medical Research Com-

mittee sent Dr. P. Fildes to Haslar as a bacteriological expert, and afforded other facilities.

Vaccines.

At the Royal Naval College, Greenwich, there is a teaching school with large laboratories and research rooms attached, which during the war has been the central establishment for the preparation of prophylactic vaccines and the distribution of curative serums to the fleet, the naval service on shore, and especially to the recently established Royal Naval Division and the Royal Naval Air Service. Here, also, most of the examinations of air, water, and food for the service afloat and the various shore dépôts called into being during the last few years have been carried out. During the war more than 2,250 bottles of antiseptic vaccine have been sent from this laboratory to the ships and fighting forces. This in 1914 was supplied by Sir Almroth Wright, but since that time has been manufactured at Greenwich from strains of pyogenic organisms isolated from wounds received in the war. For prophylactic use nearly 6,000 doses of antitetanus serum have been issued, mainly to the Royal Naval Division serving in Gallipoli and in France. During the past two years anticholera vaccine for more than 50,000 men has been supplied to the forces in the Eastern Mediterranean and Persian Gulf, and to the latter a quantity of plague prophylactic was also sent. Since the recognition of dysentery over 2,200 doses of antidyenteric serum have been dispatched for hospital use. At this laboratory and at Malta the greater part of the antityphoid vaccines used in the naval service have been prepared. The laboratories of Chatham, Haslar, Plymouth, and Malta, in which routine examinations of clinical material of all kinds (and also of the milk and food supply, and dressings) are carried on, have had a greatly increased amount of work during the war in the form of systematic examinations, both from a diagnostic and prophylactic point of view, in connexion with infectious diseases.

Antityphoid inoculations of men likely to be exposed to infection have been systematically carried out. In the first year of the war they were inoculated with a typhoid vaccine received from Sir Almroth Wright, over 5,000 bottles, containing 25 c.cm. each, being used. When paratyphoid infections became prevalent, a triple vaccine was prepared at Greenwich and Malta containing the typhoid organism and being multivalent for paratyphoid A and B, from strains isolated from cases in the Eastern Mediterranean. It contained the full dose of the typhoid germ and half the number of paratyphoid A and B. A fair degree of immunity, as judged by the agglutination test, was thus produced. The reaction is not excessive and much time and trouble are saved without sacrificing the antityphoid immunizing power. With this more than 40,000 men have received protective inoculations, and by this means the incidence of typhoid among enteric cases in 1916 was reduced from 35 per cent. in the uninoculated to 11 per cent. in the inoculated,* or 0.7 per cent. of the total forces in the endemic area, and undoubtedly the severity of the disease was considerably lessened among those who did contract the disease.

Dysentery.

The Royal Naval Division in Gallipoli in 1915 suffered, in common with the other forces on land, from diarrhoea, dysentery, enteric and obscure fevers. The numerous convalescents sent to England were filtered through the large naval hospitals to prevent the escape of any dysenteric or enteric carriers into the general population. The diagnosis on arrival was confirmed or modified by the verdict of the laboratory based on bacteriological, serological, and microscopic investigations. The result of these numerous routine examinations incidentally threw light on the duration and course of the agglutination changes due to the influence of inoculation on the one hand and of definite infection with the enteric group of micro-organisms on the other hand, and thus enabled a more accurate diagnosis to be arrived at in any given case; but it was generally recognized that for certainty of diagnosis the culture of the organism from the blood, faeces, or urine was essential. In the dysentery group of infections the percentage of entamoeba infections found was not very high, but amongst those infected there were some very obstinate carriers, resistant to all forms of

* Vide Journ. Royal Naval Medical Service, 1917, iii, 30-32.

emetine. Some vague intestinal symptoms have been traced to such organisms as Morgan I bacillus, and in one instance at least great benefit was derived from vaccine treatment with the organism isolated.

Cerebro-spinal Fever.

In 1915 cerebro-spinal fever became epidemic in

England, and during the first year of the war 170 cases of the disease occurred in the navy. Among the various precautions taken to check the spread of this disease, examination of swabs from the nasopharynx of all new entries was undertaken at the beginning of 1916. At Greenwich alone 5,000 such swabs were examined during the first half of 1916, and of 4,713 cases of healthy non-contacts 46, or 0.976 per cent., were found to be positive, the diagnosis being made on the morphological, cultural, and agglutinative characters. The percentage obtained from contact cases was 5.77. During the winter of 1916-17 up to February, over 4,000 swabs have been examined. From 3,900 non-contact cases there were 112 positive cases, or 2.8 per cent., which is considerably higher than that found in 1915-16. These were all segregated, and thus numerous infective foci were prevented from spreading the disease, which in this district has kept at about the same level as in the preceding year, although more men passed through the dépôt. In 299 instances the organisms isolated were examined by agglutination tests; of these 112 were positive and 187 negative, using the multivalent serum supplied by Flexner as the final criterion. The greater number were again tested by the four univalent strains prepared by Mervyn Gordon; of 82 so examined

36 proved to belong to the type I, 40 to type II, none to type III, and 3 to type IV; 3 did not react to any of Gordon's serums. In the subsequent examination of these carriers 81 per cent. gave no further evidence of infection, partly no doubt as a result of the prophylactic measures employed. During 1916, at the Royal Naval Hospital, Chatham, 7,220 new entries were examined, giving 94, or 0.76 per cent., positive results; among 805 close contacts there were 52 carriers, or 6 per cent., and among 527 remote contacts 6 carriers. At the Royal Naval Hospital, Haslar, among 5,000 new entries examined during January and February, 1917, there were 316, or 6.3 per cent., carriers; whereas among 2,022 new entries examined during 1916—namely, in the spring—there were no positive carriers. This corresponds with the observations at Greenwich, and suggests an "epidemic of carriers." At the Royal Naval Hospital, Plymouth, among 5,220 new entries examined during 1916 there were 117, or 2.2 per cent., carriers, and among 723 contacts 144, or 19.9 per cent., carriers.

By means of this systematic examination of new entries from outside districts the detection and segregation of carriers have been very thorough. During the second year of the war the number of cases of cerebro-spinal fever in the navy declined to 104, although the total strength

GREENWICH ROYAL NAVAL COLLEGE MEDICAL SCHOOL: PLAN OF QUEEN ANNE BUILDING.

had greatly increased. This fall in the incidence of the disease, whether entirely correlated with the coincident diminution in the cases of cerebro-spinal fever in the civil and military population, or due to prophylactic measures (quarantine of drafts, examination of contacts and new entries), is eminently satisfactory, especially as out of these 274 cases of cerebro-spinal fever in the navy during

the first two years of the war 22, or 8 per cent. only, occurred in sea-going ships. In the second year of the war the serum treatment, which had proved to be a failure in the previous year, was successful; 2,500 doses were issued from Greenwich, and the mortality fell 17 per cent., to 36 per cent. of all cases. This may be largely ascribed to the use of Flexner's multivalent meningococcic serum generously supplied gratuitously by the Rockefeller Institute, New York, and of Mervyn Gordon's various serums, which were not available during the first year of the war.

A number of cases clinically suggesting cerebro-spinal fever (meningismus) occurred, but no confirmation could be obtained by laboratory methods. The cerebro-spinal fluid was clear, though under increased pressure. No organisms were observed microscopically or by culture, and the blood did not contain any antibodies to any meningococcic strains.

Venereal Disease.

In the treatment of venereal disease, which is more in evidence than in most general civil hospitals, the essential intimate association of clinical and laboratory work is well organized. The diagnosis of syphilis by the microscopical detection of the spirochaete in the initial lesion, by the Wassermann reaction of the blood in the later stages, and by the cytological examination and the Wassermann reaction of the cerebro-spinal fluid in luetic lesions of the central nervous system is an established routine in the larger hospitals and laboratories, and the treatment by intravenous injection of arsenical compounds is universally controlled by the examination of the urine for arsenic. During 1916 the total number of Wassermann tests made was 16,766; at Haslar alone during that year 1,833 injections of arsenical compounds were given for syphilis; kharsivan was given on 1,522 occasions, galyl 55, and novo-arseno-billon 256 times.

Protozoal Infections.

As a result of the large number of men serving in tropical and subtropical regions protozoal infections have been frequent. These areas of active operations may be divided into three—(1) the Eastern Mediterranean and Mesopotamia, (2) East Africa, and (3) West Africa.

1. In the Mediterranean area malarial fevers have been most abundant around Salonica where low-lying swampy ground has been chiefly occupied; the disease has been very severe, and mostly of the malignant form caused by the *P. falciparum*, and the clinical aspect has not infrequently suggested enteric, dysentery, or sunstroke. As the infection is unfortunately very resistant to quinine, the most important prophylactic measures are the destruction of mosquitos by drainage and other methods. The largest number of cases in the navy occurred among the Royal Naval Air Service who live on shore. In the Gallipoli area malaria was not common, but short fevers of the dengue or sand-fly type, often described as "Mediterranean dengue," were very frequent. The knowledge that sand-flies are so often the infective agent has enlarged the scope of preventive measures, and a great reduction of these fevers may be expected in the future. Incidentally it is noteworthy that the prophylactic measures strictly enforced against undulant fever have practically eliminated this disease, which ten years ago would have filled the Mediterranean hospitals. This result emphasizes the value of the work done by a well-organized scientific Commission and of the practical application of its recommendations. The occurrence of many cases of beri-beri in the forces in this area proves the importance of an extended study of the food question and other factors concerned in such deficiency diseases.

2. In East Africa the necessity of thorough measures in the prophylactic issue of quinine is most important, as the prevailing type of fever is best controlled by this drug, which should be given both before and during the whole period that men are employed in the endemic area.

3. In West Africa, particularly in the Cameroon area, the varieties and frequency of protozoal and filarial diseases have been very noticeable, and prophylactic measures against them are therefore essential. Of malaria, which is very common, two types are constantly present, quartan and subtertian, the double infection being almost always found in the same case, frequently associated with Calabar swellings and filariae in the blood. In this region

tsetse flies are abundant and trypanosome infections have occurred in Europeans. Early search for these parasites is, therefore, most necessary, and appropriate treatment should be given as soon as possible. A case now at Greenwich of over eighteen months' duration shows how persistent treatment can control the disease, for there are practically no symptoms, although the parasite is pathogenic to white rats in eighteen days. The occurrence of mixed blood infections should therefore be suspected; benign and malignant malaria with trypanosomes or filariae have been found together, always associated with a high eosinophilia (up to 50 per cent.). The quartan malarial parasite is most difficult to eradicate and is very resistant to arsenic, recurring in the blood of those with trypanosome infections after a year's treatment with intravenous and intramuscular injections of antimony and arsenic.

No case of small-pox has been recorded in the navy during the period of the war, thus proving the value of vaccination, which has been compulsory since about 1858.

SURGERY.

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The equipment of naval hospitals and their treatment of the wounded are on the same lines as in the best British and Continental institutions. If Haslar be taken as an example, the critical visitor would see that all cases of bacteriological importance are diagnosed and treated in association with a perfectly equipped laboratory, in which discharges are stained, cultures are made from blood and wound discharges, vaccines are prepared, and sections are cut of tissues removed from the body for the purpose of microscopical examination. Hence it is needless to point out further how great is the importance attached to the relation between the laboratory and the treatment of surgical disease in this hospital.

Treatment of Wounds Received in War.

The whole question of aseptic and antiseptic treatment has been revised and judgements passed upon the different methods of accomplishing each branch. On the whole, authorities are not satisfied with the aseptic treatment of these wounds. Although it appears successful in some cases, it fails too often in others to encourage its general use. The hypertonic salt solution has been given complete trial, with the result just stated. Wounds undergoing this treatment are liable to secondary or mixed infections. At one time the wounds in one of the wards at Haslar became secondarily infected with *B. pyocyaneus*; the appearance of this micro-organism was at once detected, and it soon disappeared by substituting the antiseptic for the aseptic method. Secondary infections very rarely occur in efficient antiseptic treatment.

In the early part of the war an investigation was carried out in the laboratories of Greenwich and Chatham Hospitals as to the best methods of treating war wounds with various antiseptics.¹ The real problem was to find a diffusible substance which could be applied at, or as shortly as possible after, the time of infliction, and which would inhibit bacterial growth until thorough disinfection and cleansing could be effected at a field hospital. Of the various substances tested, cresol and salicylic acid produced the best results, and appeared to be the most useful for the purpose required. A cresol paste (20 per cent. in lanolin and wax base) and a powder containing equal parts of boric and salicylic acids ("borsal") were introduced. These had given excellent results in laboratory infections, but met with less success in cases from the front, on account of the difficulties of time and places incident to war conditions. Successful cases have been reported from the Gallipoli campaign in which the treatment was adopted, severe gunshot and shell wounds remaining free from suppuration and healing readily.² That a cresol or carbolic acid paste is a valuable treatment for wounds on board ship is shown in a report on various cases so treated in a battleship,³ and wounds, including compound fractures, treated in Chatham Hospital by carbolic acid cleansing and liberal introduction of cresol paste healed well without suppuration.