Summary

The organization of the catering services of a passenger ship is described.

Typical outbreaks of enteritis and gastro-enteritis are mentioned.

Differential diagnoses are discussed with reference to staphylococcal, salmonella, and dysentery infection.

Methods of dealing with an outbreak are outlined.

I wish to acknowledge the encouragement of the chairman and members of the Medical and General Committee of the Association of Sea and Air Port Health Authorities following an address based on a previous article in the *Journal of the Royal Naval Medical Service*. I also had the benefit of the comments of Dr. W. C. Lethem, of the Ministry of Food, Dr. Maurice Williams, medical officer of health, Southampton, and Dr. Morgan, medical officer to the Port of London Health Authority.

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ENTEROCOCCAL ENDOCARDITIS

BY

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In subacute bacterial endocarditis the importance of *Streptococcus viridans* as the causative organism is well recognized. It is not, however, generally appreciated that other bacteria may be involved. Out of 31 cases of streptococcal subacute bacterial endocarditis, Horder (1909) found that eight were due to *Streptococcus faecalis*, and Rantz and Kirby (1943) isolated this organism in 3 out of 16 cases of the disease. However, in large series Sirota *et al.* (1947) and Loewe *et al.* (1951) reported an incidence of the enterococcal variety of 3.2% and 3.8% respectively.

The first case of enterococcal endocarditis was described by MacCallum and Hastings in 1899, the causative organism being the *Micrococcus zymogenes*, now recognized as *Streptococcus zymogenes*. Although several cases have been reported since then, the importance of the enterococci in causing subacute bacterial endocarditis has not been stressed. The following two cases, therefore, are thought worthy of record, constituting only the fifth British report (Andrewes and Horder, 1906; Horder, 1909; Braxton-Hicks, 1912; Cates *et al.*, 1951).

Case 1

First Admission.—A locomotive foreman aged 63 was admitted to hospital on April 30, 1947, with a two-years history of increased frequency of micturition, especially nocturnal, and dysuria without haematuria, culminating in acute retention of urine. His general condition was good. The blood pressure was 165/80, and no abnormalities were recorded in the cardiovascular and respiratory systems. The bladder was distended almost to the umbilicus and the prostate was enlarged, hard, and nodular.

Under general anaesthesia a suprapubic catheterization by the Riches technique was performed, followed by daily bladder lavage. On May 15, under general anaesthesia, a modified Millin prostatectomy was performed; the prostatic capsule was sutured, the bladder was closed with prevesical drainage, and perineal urethrostomy was performed, with subsequent daily lavage. A pyrexia of 100.4° F. (38° C.) on the second post-operative day responded after three days to a full course of sulphadimidine. Convalescence was uneventful apart from a mild thrombophlebitis in the left leg, and he was discharged on June 9. When seen again some weeks later there were no urinary or other symptoms, although he had very slight oedema of the feet and some anaemia (red blood cells, 3,580,000 per c.mm.; Hb, 69%, or 10 g.); the urine contained albumin, and culture produced a growth of coliform organisms.

Second Admission.—On December 10 he was admitted to the medical department, complaining of malaise, loss of weight, and three attacks of sudden onset, consisting of dyspnoea with palpitations, throbbing headaches, and sweating; each passed off after about half an hour. Examination revealed pallor of the face and mucous membranes, with slight cyanosis, slight clubbing of the fingers, dyspnoea on movement, and evidence of loss of weight. The pulse rate was 90 a minute and collapsing in type. The blood pressure was 188/62. There was no clinical enlargement of the heart. Auscultation revealed a high-pitched musical systolic murmur maximal in the aortic area, and, it was thought at this stage, also an early diastolic murmur. There were no other abnormalities. During most of his time in hospital he had an irregular pyrexia of 99–101° F. (37.2–38.3° C.). Subsequently a definite aortic diastolic murmur became clearly audible. The urine contained a dense cloud of albumin and a moderate amount of deposit consisting of 50–100 pus cells, 10–20 red blood cells, and innumerable motile organisms per high-power microscopical field, while culture yielded a heavy growth of coliform organisms. Several unsuccessful attempts were made to overcome the urinary infection, using various combinations of sulphonamide compounds, potassium citrate, and calcium mandelate.

On January 21, 1948, after ten days' aerobic and anaerobic incubation, blood culture revealed a pure growth of a non-haemolytic *Str. faecalis*. Subsequently he received several blood transfusions, but his condition steadily deteriorated with the development of petechial haemorrhages and oedema of the legs and uraemia. Death occurred on February 8.

Necropsy Findings.—The cause of death was congestive cardiac failure. The heart weighed 720 g. and showed gross dilatation of the right auricle and ventricle and hypertrophy of both ventricles, especially in the left. Subepicardial haemorrhages were present at the junction of the superior vena cava with the auricle. Large vegetations were present on both cusps of the mitral valve, forming a protuberant mass on the aortic cusp, which showed aneurysmal bulging into the auricle. There were also vegetations on the three cusps of the aortic valve and on the wall of the aorta just above the left posterior cusp. The aorta showed a moderate degree of atheroma. At the hilum of the left lung there was an organizing thrombus of a vessel, and the lower lobe contained an infarct. The spleen contained a recent infarct of the upper pole. Small haemorrhages were found in the kidneys, throughout the submucosa of the bladder, and in the subarachnoid space on each superior parietal surface of the brain. The other organs revealed no significant changes.

On histological examination the kidneys showed healed glomerular embolization of a few glomeruli; one glomerulus was observed to contain a mass of bacteria.

Cultures from the heart valves and the spleen yielded a growth of *Str. faecalis*.

Case 2

A primigravida aged 25, who had suffered from rheumatic fever at 12 and 17 years, had a forceps delivery on November 18, 1950. Subsequently she was pyrexial, but after receiving penicillin the temperature settled and she went home three weeks later. On December 25 swelling with intermittent pain and restriction of movement began in the fingers of the right hand, gradually spreading up the forearm to the elbow. The condition lasted for about a week, and subsequently all the larger joints were affected by a wandering polyarthritis. Throughout January, 1951, she felt generally unwell and suffered from night sweats, her temperature often being about 101° F. (38.3° C.). About the end of January a blood culture showed *Str. faecalis*, insensitive to penicillin but sensitive to streptomycin, chloramphenicol, and aureomycin. She was treated with chloramphenicol, 4 g. daily for 14 days, and then, because of the nausea and malaise induced, with streptomycin, 2 g. daily for six days. Her temperature rapidly became normal. On February 18 she complained of a severe headache and her temperature was 99.8° F. (37.7° C.). She was admitted on February 19.

On examination pallor of the skin and mucous membranes and clubbing of the fingers were noted. The blood pressure was 110/60; the pulse rate was 72 a minute, collapsing in type. The apex beat was located in the fifth intercostal space, 5½ in. (14 cm.) from the midline. The cardiac impulse was forcible and heaving. The heart sounds were slapping in character; there were to-and-fro systolic and diastolic murmurs at the aortic area and a rough systolic murmur in all other areas. No other abnormalities were noted.

The blood count showed some anaemia (red cells 3,900,000 per c.mm.; Hb, 68%; white cells, 9,700 per c.mm.). On February 22 blood culture showed a heavy pure growth of *Str. faecalis* sensitive to about 10 units of penicillin, aureomycin, and chloramphenicol per ml., but insensitive to at least 100 units of streptomycin per ml. Treatment had been initiated with chloramphenicol, 3–4 g. daily, but on February 26 this was replaced with penicillin, 6,000,000 units daily, and on the 27th aureomycin, 4.5 g. daily, was added. From March 8 the temperature was normal, and the general condition became much better. The cardiovascular state improved considerably. On March 21 the haemoglobin was 84%. The patient was discharged on March 22, to continue with the penicillin and aureomycin for a further month.

She remained well during this time, but died suddenly, apparently from left ventricular failure, after a period of exertion.

Post-mortem examination of the heart showed hypertrophy and dilatation of the left auricle and ventricle, rheumatic endocarditis of the mitral and aortic valves, and the large fleshy, thrombotic vegetations of subacute bacterial endocarditis on the three aortic valve cusps and on the aortic aspect of the anteromedial cusp of the mitral valve; the vegetations were sterile on culture.

Discussion

For the development of bacterial endocarditis, as pointed out by Hadfield and Garrod (1947), two conditions are necessary: a portal of entry to the blood stream for the organisms, and a susceptible state of the heart valves.

Skinner and Edwards (1942), in their review of 37 proved cases of enterococcal endocarditis from the literature, found that in 14 in which the portal of entry was stated the urinary tract was responsible in two cases (Meyer, 1927; Fuss, 1927), and the genital tract following abortions in three others (Tidow, 1929; Dumas and Josserand, 1933; Wallach, 1934). The two cases of Meyer (1927) and Fuss (1927) had an enterococcal urinary infection, and the endocarditis followed surgical relief of a urethral stricture. Other cases have been reported following urethral manipulation, cystoscopy, or prostatectomy, by Skinner and Edwards (1942), Hein and Berg (1949), Alexander (1950), Cates *et al.* (1951), Loewe *et al.* (1951), Merritt (1951), Robbins and Tompsett (1951), and Finn and Kane (1952)—19 in all. Sirota *et al.* (1947) found in 26 cases of enterococcal endocarditis at the Mount Sinai Hospital that "the source of infection was traceable in 10 cases to recent infection or operative manipulation of the genito-urinary tract, and in one to a septic criminal abortion." Five other post-abortional cases have been reported by Waaler (1937), Harvier and Sarrazin (1948), Robbins and Tompsett (1951), and Cates *et al.* (1951). Leaman *et al.* (1949) observed a case developing one week after a full-term delivery, the organism being isolated from the cervical discharge and from the blood.

In Case 1 the portal of entry undoubtedly was associated with the operative procedures. In Case 2 infection probably occurred through the manipulation and instrumental intervention of the delivery.

It may be noted from the literature that the entry of organisms into the blood stream following urogenital procedures occurred very commonly, yet much less often resulted in bacterial endocarditis. Merritt (1951) found eight cases of endocarditis as a complication of 7,000 transurethral prostate resections, the incidence being 10% in cases known to have had valvular heart disease. This apparently confirms the importance of underlying valvular disease; nevertheless the latter may be modified by the varied characteristics of different bacterial species. Indeed, Rantz and Kirby (1943) reported that enterococcal endocarditis occurred in persons with normal valves more often than other streptococcal infections of the endocardium. They described this in two cases; likewise, Loewe *et al.* (1951), Wallach (1934), and Skinner and Edwards (1942) in four other cases. There was neither a rheumatic history nor clinical evidence of rheumatic heart disease in other cases reported by Guss (1948), Hein and Berg (1949), Dreher (1950), Merritt (1951), Loewe *et al.* (1951), and Finn and Kane (1952)—seven in all. The enterococcal infection in Case 1 was superimposed on normal heart valves.

In general the symptomatology and physical signs in enterococcal endocarditis are similar to those seen in the *Str. viridans* variety. Severe precordial pain may occur. Wallach (1934), Rantz and Kirby (1943), and Loewe *et al.* (1951) have emphasized the frequency of focal suppurative lesions in the myocardium and in the organs peripheral to the heart. In consequence splenic rupture with fatal peritonitis has twice occurred. Foci of suppuration may continually discharge organisms into the blood stream, thus necessitating prolonging the period of treatment. The actual endocarditis lesions are more of the ulcerative undermined type than the exuberant, friable, thrombotic, cauliflower-like masses of the viridans variety (Loewe *et al.*, 1951).

The enterococci are very resistant organisms, although, as regards *in vitro* inhibition of growth, sensitivity is probably greatest to aureomycin. Hunter (1950) has pointed out that sensitivity tests which measure only inhibition of growth may be misleading in regard to effective therapy—a fact borne out in respect of aureomycin (Cates *et al.*, 1951; Finn and Kane, 1952). Cates *et al.* (1951) and others have found that the addition of the bacteriostatic agents chloramphenicol, aureomycin, and terramycin reduces the *in vitro* bactericidal rate of penicillin on enterococci. In reviewing the literature since 1947, comprising 37 reports and involving 86 cases, failure of treatment was found in 46 patients. A combination of penicillin in doses of 6–12 mega units daily and streptomycin, 2 g. daily, was curative in 16 cases (Hunter 1950; Robbins and Tompsett 1951), while large doses of penicillin, over 10 mega units daily, with or without caronamide, about 24 g. daily, to augment blood concentration by inhibition of renal tubular excretion, were effective in eight cases. These two lines of treatment offer undoubted promise; they should be continued for at least six weeks and preferably longer.

Leaman *et al.* (1949) have emphasized that before initiating any treatment complete bacteriological identification and classification of the pathogen are of primary importance. This is especially so in view of the report of Wheeler and Foley (1945) that strains which would have been classified as *Str. viridans* by methods other than group precipitation tests were often found to belong to the Lancefield Group D (to which all of the four recognized species of the enterococcal group belong). Frequent assessment of the changes in sensitivity of the organism is desirable in order that the therapy may be efficiently controlled.

As pointed out by Dreher (1950), the determining factors in the success or failure of treatment are the early administration of adequate amounts of the antibiotic, the resistance of the infecting organism to the antibiotic, the critical nature of embolic phenomena, and the degree of cardiac damage, both valvular and myocardial, which precedes, accompanies, and follows treatment.

Summary

Two cases of enterococcal endocarditis—in a man aged 63 following suprapubic prostatectomy with perineal urethrostomy, and in a woman aged 25 following a forceps delivery—are described.

The importance of the enterococcus in the production of subacute bacterial endocarditis is noted, especially in cases without previous rheumatic heart disease.

The ease of production of bacteriaemia, and the possibility of endocarditis, following genito-urinary infection and manipulations, are emphasized.

The importance of proper bacteriological study of the organisms isolated in endocarditis and the determination of their sensitivity to antibiotics are stressed.

The difficulties of treatment owing to the resistance of the enterococcus are noted. Early, adequate, and prolonged therapy with appropriate antibiotics is advocated.

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Medical Memoranda

Acute Meningo-Encephalitis as a Complication of Glandular Fever

I should like to add the following case to the one I recorded previously (Librach, 1952).

CASE REPORT

An unmarried female fitter aged 19 was admitted as a case of poliomyelitis on July 12, 1952. For five days she had complained of the gradual onset of headache associated with nausea and vomiting. Previous illnesses included measles, pertussis, and chicken-pox. Tonsillectomy had been performed in infancy. She had had no recent or remote inoculations. There was no one else ill at home.

On examination her temperature was 101.6° F. (38.7° C.), pulse rate 84, and respirations 16. She was not acutely ill. Her ears, nose, and throat were normal. A few small neck glands were present. The spleen was not felt. Apart from slight neck stiffness, there were no neurological signs. Treatment included sulphonamides and penicillin for the first 48 hours.

On July 14 the temperature was normal and no meningeal signs were elicited. On July 18 she was pale, and recrudescence of headache and vomiting occurred. There was marked oral foetor and furring of the tongue. Fine lateral nystagmus to the right was seen. On July 20 a normal menstrual period began, associated with continued vomiting and an irregular blotchy erythema of the trunk. Two days later she was quite well. On July 20 minimal gland enlargement affecting the cervical, axillary, and inguinal groups was noted, together with a palpable spleen. On August 2 she was discharged home. When seen again as an outpatient on August 16 she looked well, but felt tired.

Investigations.—July 15 : White-cell count, 7,200 (polymorphs 40%, lymphocytes 44%, monocytes 16%). Glandular fever cells present. Cerebrospinal fluid : 10 ml. slightly opalescent fluid ; cells, 89 per c.mm., all small lymphocytes ; protein, 30 mg. per 100 ml. ; chlorides, 760 mg. per 100 ml. ; sugar normal ; globulin normal ; culture sterile ; no organisms seen on direct examination. Paul–Bunnell tests (blood) ; July 17, 1 in 64 ; July 26, 1 in 128+ ; July 31, 1 in 128+ ; August 18, 1 in 16.

COMMENT

Although no specific signs of glandular fever were present on admission, in the light of previous experience a white-cell count was done ; this showed a characteristic mononucleosis. The Paul–Bunnell test on the blood was at first borderline, but later showed a diagnostic rise in titre to over 1 in 128, remaining at that level for seven days, and then falling quickly to 1 in 16. The maximum titre corresponded with the occurrence of gland and splenic enlargement, but with recovery from the nervous symptoms.

In contradistinction to the previous case, the cerebrospinal fluid was abnormal and showed 89 lymphocytes per c.mm. three weeks after the first complaint of headache, and when the neurological signs had gone, minimal gland and splenic enlargement occurred—that is, the lymphadenopathy *followed* the nervous signs.

The neurological manifestations have been reviewed briefly by Tidy (1952). He stresses the importance of the timing of the Paul–Bunnell test, which may be occasionally positive in the cerebrospinal fluid. It will be recalled that the present patient was admitted as a possible non-paralytic poliomyelitis case. It would seem eminently worth while to do routine white-cell counts and Paul–Bunnell tests in these cases, for in this way more might be learnt about the behaviour of this strange malady, and its true incidence appreciated. The relation, too, of the heterophil antibody titre to the stage and severity of the illness would also prove of value, especially if tested for both in blood and cerebrospinal fluid simultaneously, for detailed information regarding both in relation to one another and to the illness is lacking.

Clinically the most striking feature, apart from the bizarre nature of the symptoms, is the rapidity with which a structure that appears to be seriously affected recovers, and this is especially so in the neurological complications. Recovery, too, is usually complete and permanent, and without residual defects or deformities. Death is an uncommon termination of glandular fever, but in the absence of an extensive literature on the neurological complications it is difficult, if not impossible, to dogmatize on the prognosis. Generally speaking, it can be said to be excellent.

There have been few reports in the literature of the pathological findings in fatal cases with C.N.S. involvement. Dolgopol and Husson (1949) describe in detail such a case which occurred in a young white woman, aged 19, whose main symptoms were diplopia and dysphagia. Macroscopically, the brain was moderately congested, the meninges equally so, but the grey matter of the cord was diffusely haemorrhagic. Microscopically, the most important features in the brain were severe degenerative changes in the nuclei of the third and fourth cranial nerves and in the ventral portion of the inferior reticular nuclei just above the inferior olives. The spinal cord showed extensive recent perivascular haemorrhages limited to the posterior horns in the upper cord but also present in the anterior horns and white matter in the lumbar segment, where some demyelination was also present.

Thomsen and Vimtrup (1939) also described six fatal cases complicated by central respiratory paralysis, one of which showed similar degenerative changes in the medulla.

In view of the current interest in bulbar poliomyelitis it might be as well to consider in differential diagnosis the bulbar involvement which occurs in glandular fever, and to perform routine Paul–Bunnell tests in such cases.

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