BACILLARY DYSENTERY.

A Survey of Treatment in the Middle East 1939-1942.

by

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From the earliest times, pestilence has been associated with war; Enteric fever, Typhus, Small-pox, Dysentery, Malaria and Yellow fever all being recorded as contributing their share to the casualties, in many campaigns to a larger extent than the missiles of the enemy. Of these diseases, Dysentery though not perhaps Captain of the men of Death has a fair claim to first place in disablement and moreover has always been of profound historic importance in that the whole course of campaign has been altered by epidemic onsets, such as that in the Prussian army after Valmy in 1792 causing the retreat which mystified the historians and ultimately permitted the rise of Napoleon; amongst the British forces at Gallipoli in 1915 and in Rommel's army at El Alamein where owing to poor hygiene, 40 to 50% of his troops were affected by dysentery/diarrhoea(1).

Dysentery has been known from the earliest times. Manson Bahr (2) in a very comprehensive bibliography to his Dysenteric Disorders notes Hippocrates, Celsus and Galen as having observed it; Galen in particular ascribing the "bloudy fluxe" to ulcers in the interior of the intestine. It is mentioned in the Bible in the Acts, Chapter XXVIII, where the father of Publius, the chief man of the island of Malta lay sick of a fever and of a bloody flux and was healed by St Paul with prayer and the laying on of hands, and it is an interesting speculation as to whether the deaths of the Egyptian first-born in Exodus, Chapter XII, may have been due to epidemic dysentery following the plague of flies.

In epidemic form, a pestilence raged in Athens during the Pelopennessian war which was probably dysenteric and the English army invading France in 1415 lost three-fourths of its effectives through a terrible epidemic (3). In more modern times, Macgrigor (4) in his sketch of the medical history of the Peninsular war says "This disease has ever been the scourge of armies --- In the regimental hospitals there were altogether admitted 7, 526 patients; but this was by no means the whole that appeared in the army, the greater part and those which were the severest cases of the disease, being treated in the general hospitals. .....Dysentery was the disease which produced the greatest mortality in the army".

Manson Bahr (6) states that the incidence in Gallipolli was 600 cases per week and Boyd (7) gives 60,000 cases, of which 95% were Bacillary; as the figures for the Middle East area 1939-42.

Table 1. gives the figures for various campaigns.

Table 2. gives the incidence as compared with enteric in the various theatres of war for the year 1917.

TABLE 1.

Campaign.	No. of Cases.	Mortality per cent.
Napoleon in Egypt.	2468	2
Crimea.	8278	28
American Civil War.	238,812 (acute) 25,670 (chronic)	2.4 13
Franco- (German Prussian. returns)	35,652	6.8
Russo-Turkish Army of the Danube.	36,198	27
South Africa 1899-01.	38,108	33
German Army in Poland. 1939.	1,200	33

TABLE 2.

	Case incidence per 1000 troops	
	Dysentery	Enteric
France	3.76.	0.7.
Macedonia	28.29.	2.5.
Egypt	23.3.	0.7.
Mesopotamia	6.34.	14.2.
E. Africa	486.56.	4.76.

Of equal if not greater military importance, however, is the wastage of man-power through disablement and the blocking of hospital beds necessitated by a lengthy period of treatment. There are no figures available as to disability, but Table 3. shows periods spent in hospital.

TABLE 3.

Dysentery 1915. (5).

	No. of Cases.	Average no. of days in hospital.
France	681	42.3
Gallipoli	2319	75.6
1917-18		
France	1568	118.3
Salonika	330	250.5
Egypt	84	143.1

(Manson Bahr estimates that 80-85% of these cases were bacillary).

In view of the seriousness of the problem, numerous efforts were made to devise means of prophylaxis comparable to that for the enteric group but without success and on the outbreak of the present war only general measures of hygiene such as detection and control of carriers, improved sanitation, protection of foodstuffs and fly control, were available. The second line of attack was improvement and increased efficiency in treatment to diminish mortality, disability, and time spent in hospital.

Treatment in early times appears to have been either depletory or sedative.

Ipecacuana was noted as in use as a specific in Brazil in 1625 and remained so until the differentiation between bacillary and amoebic showed that it and its alkaloid emetine were only specific in the latter. Antimony oxide followed by opium was in use in the eighteenth century and the use of saline aperients was introduced by Donald Munro in 1780 (2).

Macgrigor (4) gives a note of the routine adopted in the army in the Peninsula :- "Treatment is commenced by copious venesection, and immediately followed by pulv. ipecac. composit. gr.XII every hour, which was repeated three times, with plenty of warm barley water; and profuse sweating was encouraged for six to eight hours. A pill of three grains of calomel and one of opium was administered every second night, and in the intervening day ʒij of sulphat of magnesia, dissolved in a quart of light broth; the venesection was to be repeated while the state of the strength and pulse permit it, until the stools are free or nearly free of blood; following up this plan with the Dover's powder as a sudorific".

Treatment gradually lost its more drastic features and following the discovery of the amoeboid type in 1875 it was gradually realised that Ipecacuana and its derivatives were valueless in bacillary infections, and the routine treatment in the South African war consisted of the administration of salines; this with the addition of an initial dose of Castor oil and, in a few cases, anti-dysenteric serum remained standard in the war of 1914-18 with it's average stay in hospital of 125 days, and comparatively high mortality rate, but in 1917 segregation of suspects and the early admission of all cases of diarrhoea with blood or mucus in the stools to special C.C.S' was introduced, with a view to bacteriological diagnosis and treatment in the acute stage. (5).

Although some work on Bacteriophage by d'Herelle and others had been done which will be referred to, no particular advance was made in prophylaxis or treatment between the wars, the standard treatment in 1939 consisting of suitable diet, salines, anti-dysenteric serum followed by some intestinal sedative such as bismuth or kaolin. An anti-dysenteric vaccine known as "Boehncke's Dysbakta" was introduced in Germany and Besredka also produced a vaccine(8) but judging by the figures for the German army previously given they cannot have been particularly effective, if indeed they were used.

The situation at the outset of the campaigns in the middle East, therefore, was that with the introduction of large quantities of virgin soil into an area in which bacillary dysentery was endemic; (Compton (9) gives an official figure of 650 cases per annum for Alexandria with a case mortality of 5%, but considers that the case incidence is actually much higher): and where, on active service, the finer points of hygiene might not be feasible, it was to be expected that the wastage might seriously influence the military position. That it did not affect the British forces to the same extent as the enemy's is considered to be due to three factors: the presence in Egypt at critical periods of a certain number of troops who were "salted"; the energetic study and, on the whole, solution of the problems of field hygiene; the diminution of case mortality and duration in hospital by the use of sulphonamide preparations.

An interesting phenomenon in Egypt and in other sub-tropical countries, is the occurence of diarrhoea of 2-3 days duration in the great majority of newcomers shortly after their arrival. This has various local names "Gyppie Tummy", "Malta Dog" and "Hong Kong Dog" being samples; and is generally ascribed to "chill" or "change of diet". Certainly, in the case of drafts arriving from the United Kingdom in 1940 and 1941, and tempted to indulge in quantities of fruit, eggs, and ice-cream, after the limitations in this country and the long sea voyage, it was very tempting to base the etiology on dysfunction rather than infection.

In a small series of six cases of pure diarrhoea without blood or mucus investigated by Clegg and Abercrombie (10) in 1939 at Alexandria, B. Flexner was isolated in four and confirmed serologically, atypical dysentery in one and Asiaticus Mobillus in one: in two of the Flexner cases the agglutination titre of their serum against the organism isolated from their faeces rose, in four weeks, from nil to 1/150 and 1/200 respectively. Further, of a naval Medical party composed of Medical Officers, Sisters, V.A.D.s and Sick Berth Staff to the number of 150, who arrived in Alexandria in 1939 all, with 2 exceptions, who had not previously served in the Mediterranean, had attacks of "Gyppy Tummy" of varying severity in the course of the first three to four weeks. One of the Sisters went on to develop a frank dysentery of considerable severity for which she was eventually invalided but of the remainder only six became infected with any of the dysentery group during their two-and-a-half years tour. The exceptions were two Medical Officers, one of whom had had a moderate attack of dysentery in Flanders in 1917, and the other an attack in Korea in 1937. It would appear, therefore, that this illness does confer a certain limited degree of immunity and that troops who have been stationed in the country for some months before commencing active operations, as were the bulk of Wavell's army in 1940, will have a stronger resistence to the dysenteric group of organisms. Further, Gear (1) in discussing the hygiene aspects of the El Alamein victory states: "Contributing to the problem on the eve of and during the battle was the inclusion in the Eighth Army of formations fresh from over-seas and lacking that full respect for the question of insanitation and tropical ill-health which is gained only by experience in warm climates. These formations were also "unsalted", and hence suffered more from such complaints as "gyppy tummy" and sand-fly fever than the older hands".

The situation as regards hygiene varied according to the conditions in which the troops were living. In the Navy afloat, the problem was of very minor significance owing to the ease in which water and food supplies could be supervised when brought on board; the absence of flies and of waste material to encourage their presence; and the rigid rules which the Naval Health authorities promulgated and enforced as to locally purchased raw fruit and vegetables even to the extent, on one occasion, of casting overboard lettuces intended for the Commander-in-Chief's lunch. No epidemics occurred in any ship during the period and any sporadic cases could be traced to infection while on shore leave.

On shore the difficulties were greater; hospitals and barracks in permanent buildings could have their windows fly-netted and all openings into galleys and food stores protected by fine mesh wire netting; all fruit washed in a solution of permanganate of potash; and all native employees periodically examined, but there was a steady trickle of cases throughout the dysentery seasons, of which case 9, Table 8, is an example.

Where units were under canvas, or in the open desert, the problem was greatly intensified and was not assisted by the habits, or lack of such, of the natives and the enemy. Gear(1) paints a vivid picture of the situation in the desert campaign in 1942; writing of the retreat to El Alamein he states ---"apart from the disturbance the retreat caused in the hygiene organisation, it created a new problem by sweeping back hordes of natives, Bedouins, and others, to settle in an uncontrolled mass in the rear of the El Alamein lines. These natives, normally lacking in any high sanitary instincts, became a serious menace to the army, and drastic action had eventually to be taken to have them removed to harmless areas further back still". ----Of the cleaning up of captured areas--- "This was an immense task, as the enemy had left his fortresses, camps, and ports in an indescribably filthy condition ---- the enemy lines and camps at El Alamein and the bases at Matruh, Tobruk, Derna, and Benghazi were revolting in the masses of human faeces and camp debris lying everywhere. One of the hygiene officers charged with the distasteful task of supervising the clearance of the previously enemy-occupied El Alamein area reported: "That portion of the battlefield previously occupied by the enemy is just one huge fly farm, and has to be seen to be believed. Whilst both Germans and Italians order the use of shallow latrine trenches(and no oil seal), this order is scarcely ever carried out. Enemy defensive localities are obvious from the amount of faeces lying on the surface of the ground.----- In the opposite camp of the enemy, as captured ground and documents showed, hygiene was not energetically studied, and today the Italians and Germans must regretfully realize that their neglect contributed seriously to their inability to resist our attack----- though to us the excremental diseases were a bad enough problem, they became a crippling menace to the Germans and Italians owing to the absence of any hygiene control by them". In this connection, Fairbrother(11) notes a carrier rate of 10% in Italian prisoners of war but considers that this is a low estimate.

The situation was dealt with in the British forces by holding the field hygiene sections in corps and Army pools, for employment as required and allotting detachments in pursuit troops to brigades, in place of the previous more rigid divisional organisation. It was thus possible for them to get to work at a much earlier stage in the advance.

Incineration, in a simply made oil drum incinerator, of refuse and excrement reduced fly-breeding and infecting sources considerably, and units were persistently educated in the complete clearing and burning out of food tins which, if left incompletely empty, became a hotbed of flies. Gear gives 1,492 as the average for admissions of dysentery/ diarrhoea to Field Medical Units during the months of September, October, and November 1942 as against a combined average of 3,672 for pyrexia not yet diagnosed, digestive, inflammation of skin and areolar tissue, and infective hepatitis for the same period. This figure is high, but it may partly have been due to the preaching of the consultants and specialists, in season and out of season, that cases with blood and mucus in the stools should be segregated in hospital at the earliest possible moment.

Hospital treatment of dysentery from 1939 to early in 1941 consisted in applying the methods of one's predecessors with such modifications and additions as suggested themselves. Two wards with a total of one hundred and forty beds were reserved for diarrhoea/dysentery cases, though at the height of one season more than double that number had to be brought into use. After considerable discussion, the administrative authority agreed to leave the medical Officers, Sisters, and ward staff of these wards unchanged during the busy months, to ensure continuity of treatment and nursing, and the results justified this policy as the Sisters and staff became interested in the management of these cases and adept at the inspection of stools. The number of these per twenty four hours was noted, preferably by the patient, who could thus assess his progress, and all stools had to be passed into bedpans until progress was such that they were formed and normal in appearance.

For convenience, a scale of diet was drawn up, to which the majority responded well; each case however was dealt with on its merits and items could be added more gradually if necessary; every patient was encouraged to drink large quantities of fluid either in the form of plain water or well diluted orange juice.

TABLE 4. (12)

Scheme of diet for dysentery cases.

No. 0.	Water (twenty four hours).
No. 1.	Beef tea, barley water, diluted orange juice, tea without milk.
No. 2.	Beef tea, jelly, barley water, custard, clear soup, thin toast and butter, orange juice, tea without milk.
No. 3.	Fish(boiled or steamed), mashed potatoes, marmite, custard, eggs, toast and butter, tea with milk.
No. 4.	No. 3. with the addition of chicken for dinner and porridge for breakfast.
No. 5.	Chicken for dinner, ordinary diet for breakfast, tea and supper.
No. 6.	Full Diet.

Cases with a duration of three days or less who were not dehydrated, were given half an ounce of castor oil on admission and thereafter one drachm of sodium sulphate four hourly. Cases of longer duration were not given castor oil but were put straight on sodium sulphate. Dehydration responded well to drip transfusion of normal saline with five per cent glucose added, but in cases where the systolic blood pressure had fallen below 100mm of mercury indicating peripheral vascular failure, it was necessary to give up to two pints of plasma before or during the glucose saline treatment.

Anti-dysenteric serum (Shiga) gave good results in infections with that organism but had no effect on other members of the group. The initial dose was 40,000 units intravenously and up to a total of 100,000 units could be given without distress. At first, serum was only given after bacteriological confirmation of the infecting organism but it was found that there were no ill effects, though no benefit, in cases of Flexner infection so that latterly all cases of severe type evidenced by toxaemia, dehydration and a stool rate of anything from fifteen to incontinence, were given 40,000 units intramuscularly on admission. This procedure saved time and if the infection proved to be Shiga, as the majority of these cases were, the balance of 60,000 units could be added to the glucose saline drip transfusion. Though the results in these cases were satisfactory, they were not as spectular as those later obtained with sulphaguanadin; serum rash appeared in about fifty per cent of cases and one had the impression that there was an increased liability to the development of arthritis; further it left untouched the severe Flexner infection. Bulmer and Priest in their series (13) only used serum in eight cases but had the advantage of a more plentiful supply of sulphaguanadine. Polyvalent serum was found to be ineffective and its use was discontinued.

One of the most hotly debated points in these years was the value or otherwise of bacteriophage in prophylaxis and treatment of bacillary dysentery. d'Herelle having carried out some of his original work on this substance in Alexandria, it was to be expected that it might be in use there. This proved to be the case; bacteriophage was regarded as a specific for "Gyppy tummy" and dysentery by the majority of members of the European colonies and the European civil practitioners in Egypt. Compton (14) ---claims that its use prevents the development of diarrhoeas and "Gyppy tummies" into full blown dysenteries. He was good enough to provide a supply to the hospital, and with the co-operation of Major Jameson, R.A.M.C. who was responsible for the bacteriology, treatment was instituted in selected cases, the criterion in each being that it must be bacteriologically positive and of not more than three days duration. With the amount available, thirteen cases were treated, with nine controls. The results showed no consistance; five of the bacteriophage cases recovered in two days less than the controls, four in the same time and of the remaining four, three required all the resources available including serum. The numbers were admittedly small but in view of the results as contrasted with the claims made, it was not considered worth continuing. (14).

The questions at issue appear to be finally decided in a paper by Boyd and Portnoy (16). They commence with a brief summary of the literature, giving twenty references which reveal much diversity of opinion and results, and in the majority of which no controls are mentioned. They then go on to give the figures of two seperate controlled trials, The first of these was inadvertant, and took place in a camp for Italian internees some of whom were being supplied with bacteriophage by their relatives outside and who were treating themselves.

TABLE 5.

Dysentery rate per thousand internees.

	Bacteriophage.	No bacteriophage.
May	3.52	3.19
June	8.23	2.47
July	4.88	1.60
August	3.32	1.42

The second took place in a camp for German prisoners - of - war. Over a period of sixty-one days in the dysentery season, occupants of three compounds were given a prophylactic dose of bacteriophage daily for 3 days - three other compounds were used as controls; this being obtained from the captured German medical stores and tested against the dysenteric group before use.

TABLE 6.

	Bacteriophage.	Control
Daily average strength	4,070	4,590
Total with diarrhoea	347	283
% at risk with diarrhoea	8.52	6.16
Total cases of dysentery	126	136
% at risk with dysentery	3.1	2.96

TABLE 7.

Treatment of established cases.

	Control	Bacteriophage
Number of cases	126	124
Average number of days for blood and mucus to disappear.	9.03	9.08
Average stay in hospital (days)	19.83	16.97

Their conclusions were that, using accurate controls:

(1) No prophylactic action was found to occur.

(2) The incidence in a treated community was no different to that in a control community.

(3) The severity and duration of the attack was not affected by treatment with bacteriophage.

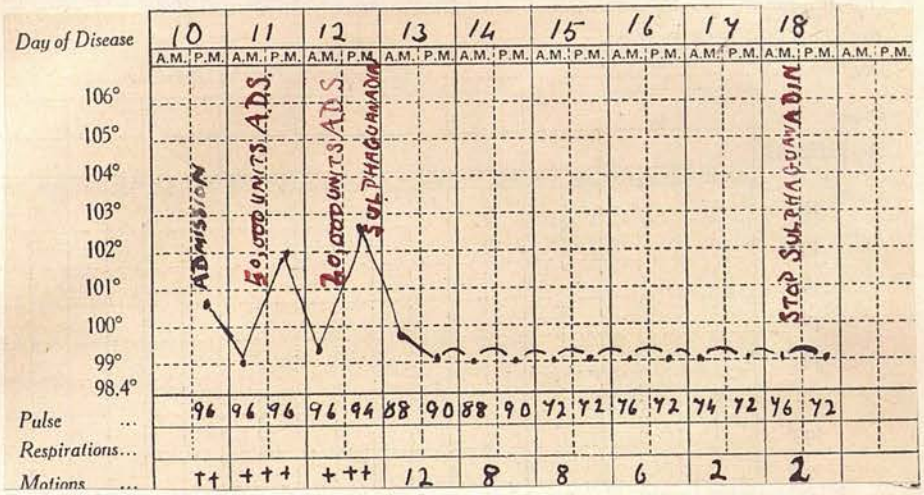
During 1940, after the entry of Italy into the war, the the numbers of individuals of all Services at risk increased largely, and from a study of the correspondingly increased number of cases, it was possible to classify them clinically into three groups, mild, moderate, and severe. The mild group comprised about 70% of all admissions and included the diarrhoeas and the "Gyppy tummies" as well as the dysenteries proper. None of these had a temperature over 100 degrees,F., nor more than ten ten stools in twenty-four hours; they were not particularly ill, provided they were got under treatment within three days of onset, and the organism was usually either B. Schmitz or B. Sonne. The great majority cleared up rapidly and satisfactorily without other treatment than one dose of castor oil followed by twenty-four hours on water only after which diet could be increased according to scale: a few required a further twenty-four hours on sodium sulphate. The moderate group, which corresponded roughly to infections with B. Flexner I and II had temperatures up to 102 degrees,F., pulse rate up to 110, and stools up to twenty per day. They looked ill on admission and took on an average twenty-five days in hospital, followed by a period of convalescence. The severe group were mainly those with B. Shiga infections. In this group, the temperature might be anything from 99 degrees to 104 degrees F., pulse 120 to 140, stools anything from twenty to complete incontinence. They were generally suffering from dehydration and more or less severe toxaemia. These were treated by serum and intravenous fluids but might take months to struggle back to health, and were a very real problem in treatment, though they only formed ten per cent of the total.

It was thought, therefore, that it would be worth while trying the effect of a sulphonamide on some of the cases in the second and third groups and as there were ample supplies of it, sulphapyridine was selected in preference to sulphanilamide. In all fifty cases were treated of which forty-five were moderate. The results were satisfactory up to a point; temperature subsided and the number of stools fell to single figures in three to four days but in order to achieve this, it was necessary to give thirteen grams in the first twenty-four hours followed by six grams in each succeeding twenty-four period and most of the cases suffered severely from nausea, vomiting and general malaise, so that in some cases it was necessary to stop treatment. Bulmer and Priest (13) obtained similar results in ninety-seven cases which they treated with sulphapyridin, but had poor results in sixty-three cases treated with sulphanilamide. They also comment on the undesirable reactions.

Sulphaguanadin was first introduced in the Middle East in January 1941, and at first the supply was very limited indeed; so much so that the only cases in which it was employed were Shiga infections of severe type which were not responding to other forms of treatment. This restriction is reflected in the early cases in the series in which it was not given on admission as compared with the later cases when supplies were more plentiful; though up till February, 1942, its use was limited to Shiga infections or severe infections of other organisms of the group, or in cases where the individual was a key man and was required back to duty at the earliest possible moment. In all, from 7/2/41 to 19/12/41, fifty seven cases were treated.

The following case reports are examples of the type of case, and the treatment employed.

Case 1.



History: admitted to C.C.S. on 3rd day of disease, remaining there till 7th day. Stated to have had an average of 30 stools per day with blood and mucus. Treatment so far as known - Mist. Bismuth. and fluids. Transferred to Hospital Ship for passage on day 7 - Temp. 101.2, pulse 112 - stools continuous - given 20,000 units A.D.S. followed by 30,000 units and 1 pint of blood. Admitted to hospital on day 10; very dehydrated, incontinent, with much blood and mucus in stools. Lab. report - B. Shiga.

Progress:

Day 11. Complete incontinence, 50,000 units A.D.S. given, routine Sod. Sulph. Morphin gr. $\frac{1}{8}$.

Day 12. Complete incontinence, 30,000 units A.D.S. and 2 pints 10% glucose saline. Sulphaguanadin commenced at 2030, all other treatment stopped.

Day 13. Stools 12, but none between 2030 and 0030 and has slept well. No blood in stools.

Day 14. Improvement continued.

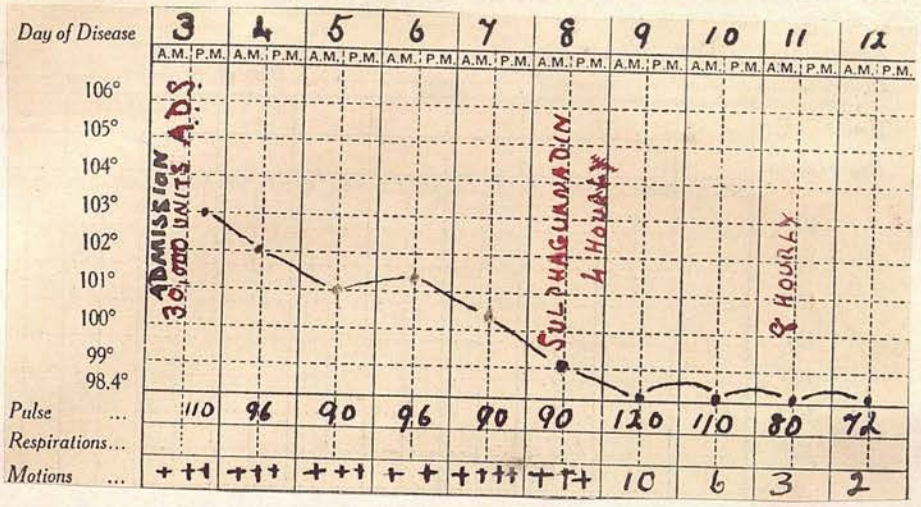
Day 16. Stools 6. Sulphaguanadin 8-hourly.

Day 18. Stools 2. Stop sulphaguanadin.

Day 29. Stool 1 - clear of mucus.

Day 46. To convalescent depot.

Case 3.



History: admitted with a history of two days diarrhoea increasing in frequency, and abdominal pain. On admission, looked sick, hot and flushed. Generalised tenderness over abdomen, most marked over descending colon and sigmoid. Stool - blood and mucus. 30,000 units A.D.S. and routine Sod. Sulph.

Progress:

Up to day 8, his condition remained without much improvement - frequent stools with blood and mucus, and on day 8 incontinent. Put on sulphaguanadin at 2000 hours.

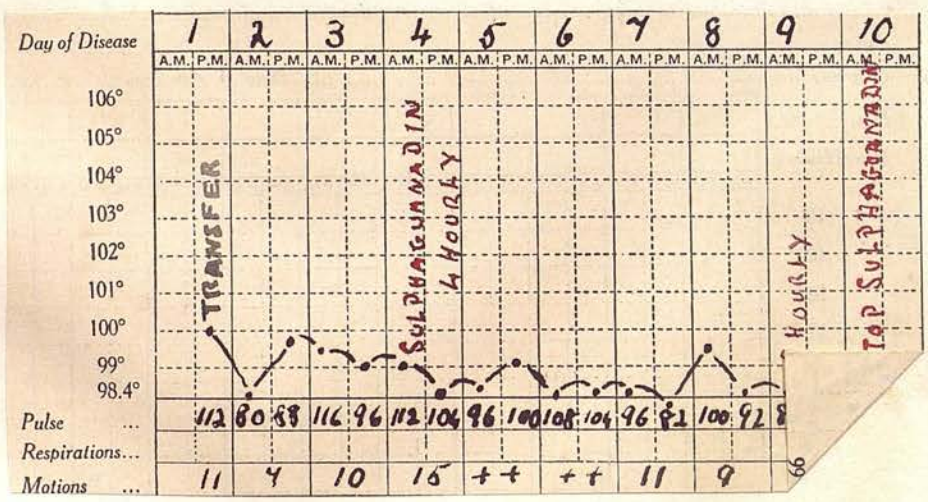
Day 9. Big improvement p.m. - no stoolbetween 1300 and 1800 hours. Saline drip - 2 pints

Day 11. Stools 3. Sulphaguanadin 8-hourly.

Day 15. Stool normal.

Day 23. Discharged to duty.

Case 9.



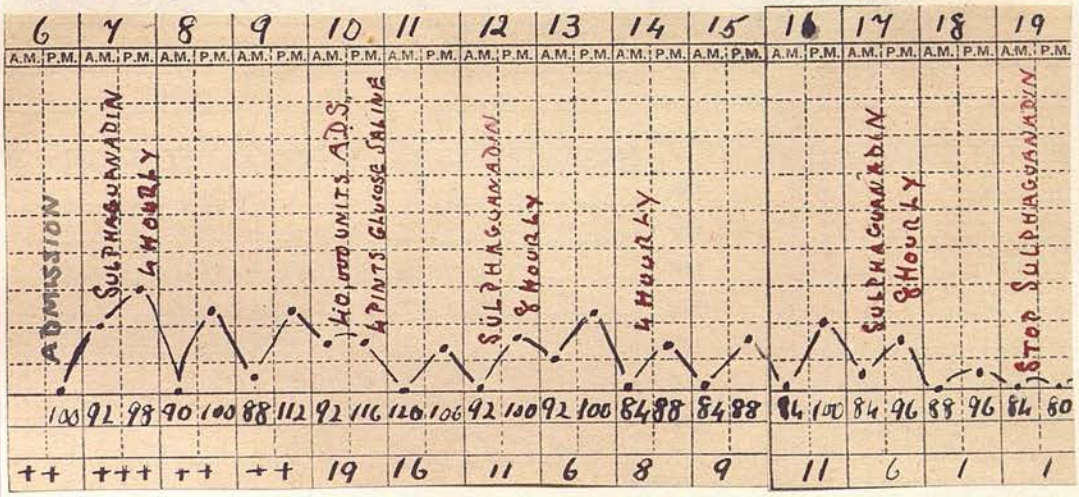
History: Sustained extensive 2nd and 3rd degree burns in action and was admitted to hospital. Condition improved but on day 41 he complained of diarrhoea with blood and mucus. Lab. report B. Shiga. Transferred to dysentery ward.

On admission: condition fair, no tenesmus, slight abdominal tenderness in right and left iliac fossae. R.B.C. 3,740,000. Hb. 72%.

Progress:

Day 4. Stools 10. Put on sulphaguanadin.
Day 5. Condition stationary.
Day 6. Condition improved. Not so toxic.
Day 8. No. 3 diet.
Day 9. Stools 5. No. 4 diet. Sulphaguanadin 8-hourly.
Day 10. Stools 2. Stop sulphaguanadin.
Day 17. Discharged to convalescent depot.

Case 27.

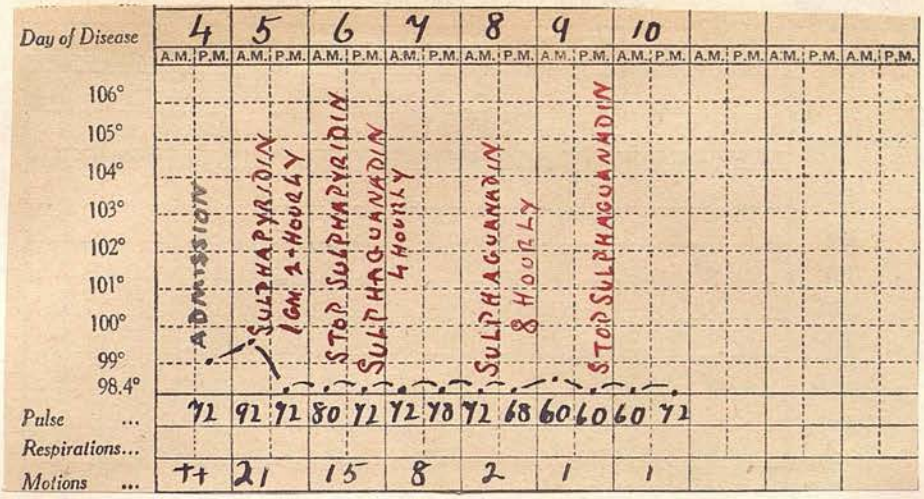


History: Five days diarrhoea with blood and mucus for one day. Headache, nausea, griping and tenesmus. On admission, looked ill and dehydrated. Abdomen tender in left iliac fossa. Fluids only.

Progress:

Day 6. Incontinent. Sulphaguanadin 4-hourly.
Day 7. Incontinent. Tinct. Opii. mX nocte.
Day 9. Stools 19. 40,000 units A.D.S. 4 pints glucose saline 5%.
Day 10. Stools 17. Looks better.
Day 11. Stools 11. Sulphaguanadin 8-hourly.
Day 12. Stools 6.
Day 13. Stools 8. Sulphaguanadin 4-hourly.
Day 16. Stools 6. Sulphaguanadin 8-hourly.
Day 17. Stool 1 - normal in appearance.
Day 19. Stop sulphaguanadin.
Day 33. Discharged to duty.

Case 28.

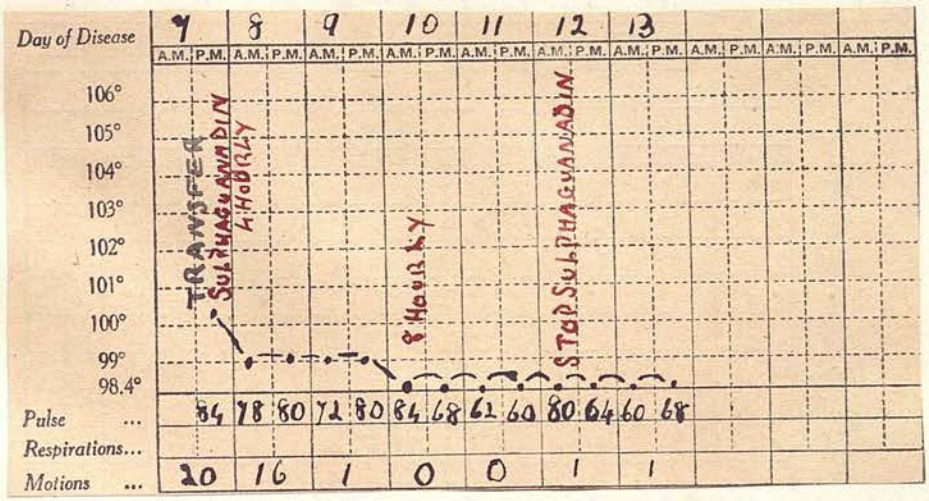


History: Three days diarrhoea with blood and mucus for one day. Griping, tenesmus and nausea but no vomiting. On admission, incontinent, very tender in left iliac fossa. Lab. report - B. Shiga.

Progress:

Day 5. Stools 21. Sulphapyridin 1gm. 4-hourly.
Day 6. Stools 15. Stop sulphapyridin. Begin sulphaguanadin 4-hourly.
Day 7. Stools 8. Feeling much better.
Day 8. Stools 2. Sulphaguanadin 8-hourly.
Day 9. Stools 1. Stop sulphaguanadin.
Day 12. Ordinary diet.

Case 29.



History: Admitted to C.C.S. with three days diarrhoea and griping. No vomiting. Diagnosed as acute appendicitis and transferred to hospital. At operation, free fluid present and lower 2 inches of ileum congested. Lab. report of stool - B. Shiga. Put on sulphaguanadin.

Progress:

Day 8. Stools 16.
Day 10. Stools-nil. Sulphaguanadin 8-hourly.
Day 12. Stools 1. Stop sulphaguanadin.

The results in the first thirty cases are summarised in Table 8, on the following page.

Table 8.(cont.)

25	Indef	27	5	6	9	14	72	
26	Shiga	25	3	21	26	30	120	Relapse. See case notes
27	Shiga	incont.	6	7	18	30	208	See case notes.
28	Shiga	incont.	4	6	9	20	60	Sulphapyridin day 5.
29	Shiga	incont.	7	7	10	22	96	Admitted as appendix. See case notes.
30	Shiga	12	2	2	7	14	72	

It will be noted that, in several of these cases, there was a failure of response to sulphapyridin prior to treatment with sulphaguanadin; this led to the restriction of sulphapyridin to moderate cases, in which the results were good, provided the course could be completed in forty-eight hours. Anti-Dysenteric serum (Shiga) was given in all cases in which toxaemia was marked and was considered to have a complementary action with sulphaguanadin.

Deaths.

Case 2.

Admitted on 4th day of disease, with history of diarrhoea; temp. 98.6, pulse 72, loose stools with blood and mucus. Lab. report: indefinite exudate.

Progress: put on routine treatment with sodium sulphate and fluids and appeared to be doing well until day 13 when temperature rose to 102.2 and thereafter commenced to swing, stools still containing blood and mucus.

Day 14-16. Emetin, gr. ½ b.d. given empirically on account of doubtful laboratory report but without effect.

Day 17. 40,000 units A.D.S.
" 18. 40,000 units A.D.S.
" 19. Stools 10- blood and mucus still present.
" 21. R.B.C. 4,670,000 , Hb. 65%.
" 23. Whole blood transfusion - 2 pints.
" 25. Condition not improving. Put on sulphaguanadin. 30 gms used but without effect on general condition or number of stools.
" 28. Temp. 99.2, stools 12.
" 32. Temp. 101.6, caecostomy performed.
" 39. Collapse - whole blood transfusion, 2 pints.
" 45. Died. P.M. showed very considerable ulceration of whole colon.

This is a typical example of the progress of a severe case before the advent of sulphaguanadin, which in this case was given too late in the course of the disease to be effective.

Case 6.

Date of onset not known, as patient was one of a hospital convoy from Tobruk, where he had had dysentery for four or five weeks, being treated with sodium sulphate as an ambulant case.

On admission; temp.99, pulse 120, extremely exhausted and emaciated. Incontinence of faeces which consisted chiefly of blood and mucus. Put on plasma drip, 2 pints followed by glucose saline to 5 pints. Sulphaguanadin started and continued four-hourly.

Progress: Condition gradually deteriorated and he died on the fifth day after admission.

P.M. Large bowel ulcerated to such an extent that, over large areas, no mucus menbrane was present. Muscular coat was very much thinned-out and looked as if it might perforate at any moment. The actual cause of death was peripheral vascular failure.

This was a rather hopeless case from the day of admission, since one was dealing with the sequel, rather than the infection itself.

Case 11.

Admitted on 4th. day of disease, with a history of diarrhoea containing blood and mucus, tenesmus and griping. Had been given castor oil followed by Mist. Bismuth et Chlorodyn.

On admission: Temp.100, pulse 120, looks toxic and dehydrated. Sodium sulphate, 40,000 units A.D.S.

Progress: Lab.report-B.Shiga, incontinent and toxic, A.D.S. 40,000 units.

Day 7. Still toxic, stools frequent, blood and mucus. Sulphapyridin 2 gm. followed by 1gm four-hourly up to 15 gms.

" 8. Cyanosed. Stools frequent, blood and mucus.

" 9. Sulphapyridin stopped. Stools 17.

" 11. Still very toxic, c/o abdominal pain.

" 13. Stools more loose and frequent.

" 15. Sulphaguanadin 8gm. followed by 4gm four-hourly

" 16. Not so well. R.B.C. 5,000,000, Hb.95%. Blood transfusion 1 pint, followed by glucose saline 1 pint; 40,000 units A.D.S. given in drip.

" 17. Much improved. Taking fluids well.

" 18. Not so well. Purpura on pressure points. C/o abdominal pain.

" 19. Died. P.M. showed peritonitis due to a recent perforation of the sigmoid colon.

This case illustrates, firstly, the toxaemia resulting from absorption when peristalsis is checked by sedatives such as bismuth and chlorodyne. Secondly, the fact that, as in case 2, sulphaguanadin was given too late to affect the issue. In this connection, the delay of 2.6 days between admission and the start of sulphaguanadin, was due to the necessity of waiting for confirmation of the Shiga infection. Had supplies warranted the start of treatment on the first day, it is possible that better results would have ensued.

The dosage in all cases was standardised at an initial dose of .1 gram per kilo. of body weight followed by .05 grams per kilo. four hourly until the stools had fallen, in number, to five in twenty-four hours, after which the same quantity was given eight hourly till stools were normal. In practice, this amounted to an initial dose of 8 grams and subsequent doses of 4 grams. The average amount used per case was 85 grams and the average duration of the course three and a half days. There were, however, extraordinary variations in the amount used, several cases for example, required only 60 grams while case 27 held the record with 208 grams. In none of these cases, was there any evidence of drug toxaemia, rashes or renal impairment, contrary to the findings of Smith (17) who observed toxic rashes in fifty per cent of his cases, and of Bunting and Levan. The former however was giving a course of 142 grams over a period of ten days and the latter a total dosage of 105 grams spread over ten days; nor were there any cases of confusional psychoses as reported by Crofton and Diggle. Bulmer (q.v.) reports only four rashes in 323 cases.

In the first ten cases stools were examined bacteriologically after the second day of the course but as they were uniformly negative, and the laboratory was working at high pressure, this was given up. Fairbrother (11) however, obtained satisfactory cure in 227 out of 245 carriers of Shiga, Flexner, and Schmitz, using 63 grams of sulphaguanadin, though he was not so successful with carriers of Sonne. It is probable therefore that, in one's own series, there would be no carriers. One of the most pleasing features in treatment, was the rapid increase in the comfort of the patient. Even although the number of stools was still high, malaise and abdominal pain had usually disappeared by the second day of the course, and patients began to clamour for more solid food than their condition justified. The two main complications, arthritis and toxic myocarditis, both of them requiring long periods of rest, decreased almost to nothing. The average stay in hospital of the series, excluding the deaths, was twenty-one days and only one (case 1.) exceeded thirty days.

As regards the treatment of complications in the pre-sulphaguanadin period, caecostomy was performed in six cases in which there was haemorrhage from the bowel which resisted other forms of treatment. In five of them this was entirely successful in checking the haemorrhage; in the sixth, a massive haemorrhage, similar to that in enteric fever, was partially controlled, but as oozing continued, and the patient was losing ground, a transverse colostomy was performed in view of the fact that a skiagram showed that only the descending colon was involved. This procedure stopped further blood loss, and the patient made a good recovery, the colostomy being closed twelve months later. Hiccough occurred in six cases, in three of which it heralded perforation and death; the other three were nursed in the Fowler position, kept on No. 2 diet, and given Luminal in $\frac{1}{2}$gr. doses thrice daily; they eventually recovered.

Arthritis, mainly of the knee joints, was not quickly responsive to any form of treatment though many were tried. Rest in bed, massage, and Scott's dressing appeared to give the best results.

The results obtained over the whole period from September 1939 to March 1942 are shown in table 9.

TABLE 9.

Case of diarrhoea and "Gyppy tummy" (bacteriologically negative).	1,842
Cases of bacillary dysentery (bacteriologically positive).	1,978
Total	3,820

Average duration in hospital.

Diarrhoea group		(48%)	10 days
Dysentery group	Mild	(20%)	12 days
	Moderate	(20%)	15 days
	Severe	(10%)	
Without sulphaguanadin			40 days
With sulphaguanadin			21 days

Deaths (dysentery cases only)	7. (.35%)
Causes of death :	
Perforation of large bowel	3.
Peripheral vascular failure	1.
Toxaemia (1. fulminating)	2.
Pneumonia (post-dysenteric)	1.

Bulmer in a discussion at a meeting of the Royal Society of Tropical Medicine and Hygiene (20), covering a slightly later period, when the supply of sulphaguanadin was more plentiful, gives very similar figures. 203 acute cases treated, had an average stay in hospital of 17 days; number of stools at commencement of treatment was 16 falling to two or three by the fifth day and being normal by the seventh. 17 cases of diarrhoea treated with sulphaguanadin had an average stay of six days, and 74 cases of mild dysentery an average stay of ten days. In a series of moderate cases with controls there was a difference of five days in favour of treated cases (11-16). Anderson and Cruikshank(21), in an epidemic in a Mental hospital, report on 41 cases treated with sulphaguanadin against 55 untreated. They had two deaths in the first and three in the second group; of 43 specimens of faeces examined in the first group at the end of seven days, only four were positive, whereas 14 out of 54 similar specimens in the second group were positive. They comment on the rapid improvement under treatment, and state that the only case showing a rash was under treatment for ten days.

Baker (23), in a series treated in an Australian General Hospital estimates the duration of illness was shortened by seven days compared with treatment by Sodium Sulphate. Page (24) reports 520 cases treated in North Africa with no deaths or serious complications. Brodie, Jamieson and Stiven (25), in 200 cases in Dundee, treated 100 with sulphaguanadin, 50 with saline, and 50 with chalk; the results, both clinically and bacteriologically were much better in the first group. Bloom(26), treating British prisoners - of - war in Italian hands reports immense improvement in his cases. On the other hand, Fairbrother(11) and others, have not reported so favourably on the effect in infections with B. Sonne, especially in regard to clearance of carriers, Fairbrother suggesting that this may be due to the more saprophytic existence of this organism. Scadding(27) in a comparative study, advances a claim for sulphanilamide, especially in chronic cases, but agrees with the low incidence of toxic effects in sulphaguanadin.

The solution of the problem of bacillary dysentery, and the diminution of mortality and disability rates, in the armed forces would appear, therefore, to rest, pending the production of a satisfactory vaccine, on the two pillars of good hygiene and early and efficient treatment. The figures given show the gain in time resulting from admission and the start of treatment on the first or second day of the disease, however contrary this policy may be to the feelings of the unit medical officer or the patient. While segregation of the diarrhoea/dysentery group in special hospitals, as was done in 1917-18, may have some advantages, it is considered better to treat this group in a section of a general hospital, provided that the medical and nursing staffs of the section can be maintained unchanged for a reasonable period; by so doing, the number of beds can be easily varied according to the seasonal incidence, while the trained staff can act as a foundation on which to build in the event of a large epidemic. The scale of diet in Table 4. was originally devised as a convenience, in a ward of 100 beds, but with an experienced Sister, it can be made sufficiently flexible to suit the individual case which is essential, as no two are exactly alike. In fact, each case must be dealt with on its merits, and the gravest error is to treat dysentery patients by strict routine.

It is considered that there is sufficient evidence of the value of the sulphonamides, both in shortening the period of illness and in lowering case mortality, but while sulphanilamide and sulphapyridin may have their uses in the mild and moderate cases, sulphaguanadin is the preparation of choice from its lack of toxicity and unpleasant side effects, especially as, if treatment is commenced early there should be no need to continue for more than five days. The severe Shiga infection is a medical emergency and will require all the resources of nursing, dietary, and the full armamentarium of sulphaguanadin, serum, intravenous plasma and saline, but even in this type of case, if treatment is commenced early enough the results can be surprisingly good.

Taken as a whole therefore, and even conceding, which is debatable, that the type in 1939-42 was of lower virulence than in 1914-18, it is submitted that the results in the Middle East show that the problem of bacillary dysentery can be brought under control. Only the mildest infection of all, that of B. Sonne remains, not so much from the aspect of the actual illness as from that of the carrier state which does not respond so well to sulphaguanadin; Swyer and Yang (28) however, report encouraging results with a newer sulphonamide preparation, so that with thorough bacteriological test of cure, the carrier difficulty seems also to be on the way to solution.

Summary.

(1) Figures of the incidence, case mortality, and duration in hospital of bacillary dysentery in previous campaigns are shown for comparison with those in the Middle Eastern theatre from 1939 to 1942.

(2) The preventive measures are briefly outlined.

(3) The question of bacteriophage in prophylaxis and treatment is discussed.

(4) The early and later treatment of bacillary dysentery is described.

(5) Evidence is given of the value of the sulphonamide group, especially sulphaguanadin, including tables of cases and results which show an improvement on previous campaigns.

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