dialyser was tipped vertically, with the blood flowing downwards during the last 10 minutes of dialysis, and was then rinsed with saline. Cole *et al.* (1962) estimated that the loss of red cells was reduced by a half to one-quarter. This change in the wash-back technique resulted in a reduction in average transfusion requirements from 5 units/month to 2.5 units/month.

Cole *et al.* (1963), again using Kiil dialysers, made some measurements of the volume of blood remaining in the dialyser and extracorporeal circuit by means of two wash-back techniques. In the first the dialyser was kept in the horizontal position throughout and 400 ml. of saline was used to rinse back the blood. With this technique the mean volume of blood remaining was 140 ml. (32 determinations). The second wash-back technique used was rather complicated and involved elevation of the arterial end of the dialyser by 15 in. (38 cm.) during the last half-hour of dialysis. In addition the dialysate flow was changed from countercurrent to concurrent by switching the dialysate tubes to opposite ends of the dialyser and increasing the dialysate flow from 500 ml./minute to 3–4 litres/minute. The dialyser was then rinsed with saline, 100-ml. aliquots being run in via the arterial blood line with the dialysate flow temporarily stopped. The dialysate flow was then increased again to 3–4 litres/minute until blood flow ceased. This process was repeated until a total of 400 ml. of saline had been used to rinse the dialyser. With this technique the mean volume of blood remaining in the dialyser was very significantly reduced to 35 ml. (92 determinations).

Johnson *et al.* (1966), also using Kiil dialysers, rinsed the dialyser at the end of dialysis with 150–250 ml. of saline and found an average of 20 ml. of blood left behind. These workers do not state whether the dialyser was tilted in any way towards the end of dialysis.

In the present study we have confirmed that large volumes of blood may remain in the Kiil dialyser at the end of dialysis. Various wash-back techniques are compared, the most satisfactory of which involves tipping the dialyser vertically, with the blood flowing downwards, during the last half-hour of dialysis and rinsing with 1 litre of saline at the end of dialysis.

The mean volume of blood remaining when this technique was employed in nine experiments with the same dialyser was 16.9 ml. This method was then used in nine different dialysers, the mean volume of blood in the nine dialysers being 12.6 ml. Another factor contributing to these results is the improvement in the quality of the dialysers now produced by various manufacturers. It is notable that in five dialysers, four of which were produced in the last year, blood losses with the above wash-back technique were extremely small, with a mean of 3.1 ml. (range 0.4–6.4 ml.). It is also essential to be able to tip the Kiil dialyser vertically towards the end of dialysis, and trolleys designed to hold these dialysers must incorporate this facility.

Summary

Large volumes of blood may remain in the Kiil dialyser and extracorporeal circuit at the end of dialysis if inefficient wash-back techniques are employed and will contribute to the anaemia of patients on intermittent haemodialysis.

Several wash-back techniques were tried, and in three of these the mean volume of blood remaining in the Kiil dialyser and extracorporeal circuit varied from 52.9 to 143 ml.

The most efficient method used involves tipping the dialyser vertically so that the blood flows from the top downwards during the last half-hour of dialysis and rinsing with 1 litre of 0.9% saline at the end of dialysis.

This method was used with nine different Kiil dialysers. The mean volume of blood remaining in the dialyser and extracorporeal circuit was 12.6 ml.

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Traveller's Diarrhoea: a Survey of Symptoms, Occurrence, and Possible Prophylaxis

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Traveller's diarrhoea, described by Gordon (1965) as a notorious world-wide illness lasting one to three days, presents a precipitous onset of loose stools and variable symptoms, including nausea, vomiting, abdominal cramps, etc. It often occurs sporadically as isolated cases, though epidemics occur within families or groups of travellers of all ages. The incidence varies according to geographical locations (Kean and Waters, 1958).

Previous studies (bacteriological and prophylactic) have been undertaken (Lie Kian Joe, 1956; Kean and Waters, 1959; Varela *et al.*, 1959; Kean *et al.*, 1962; Nelson *et al.*, 1962) without producing definite conclusions regarding the value of prophylactics or the causal relation between diarrhoea and considered pathogens.

Dr. D. J. Cussen attended the U.K. Olympic teams in Rome 1960 and gave one tablet of Streptotriad twice daily; other

teams had an appreciable amount of diarrhoea, but no cases occurred in the U.K. teams. As neomycin is widely used in gut infections, it was decided to undertake an extensive controlled prophylactic trial comparing Streptotriad, a neomycin-sulphonamides compound, and a placebo in B.O.A.C. personnel and their families going abroad.

Method

Tablets A, B, and C were randomly allocated to 1,383 subjects (see Table), except that complete families were given the same tablet to avoid interchange of medication. Anyone with known drug allergy was excluded. Participants were told to maintain their usual standards of food hygiene and received instructions regarding dosage and duration of medication as follows: one tablet twice daily for the first two weeks while away, one tablet daily for the third week, then stop. Children under 12 years were given half this dosage. Two sealed letters indicating the

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identity of the tablets were given to each participant—one addressed to the B.O.A.C. appointed doctor at the visited territory and one to the subject's local doctor. One of these was to be given to the appropriate doctor if diarrhoea developed during the overseas visit or on return home. A questionnaire was completed by each patient, and the data were coded and analysed by means of a punch-card system.

There were three males for every two females; 10% were 19 years or less, 20% 50 years and over, and the remainder 20 to 49.

Treatment Groups

Group A. Inert control	385
Group B. Neomycin-sulphonamides (each tablet containing neomycin sulphate 200 mg., sulphadimidine 100 mg., sulphadiazine 100 mg., and sulphathiazole 100 mg.)	355
Group C. Streptotriad (each tablet containing streptomycin sulphate 65 mg., sulphadimidine 100 mg., sulphadiazine 100 mg., and sulphathiazole 100 mg.)	364
Excluded from analysis	279*
	1,383

* 258 failed to comply, 21 stopped tablets within five days because of reaction or side-effects (details see below).

Results

Just over 1,100 completed the survey with practically equal numbers in each treatment group. Streptotriad was found to be beneficial in reducing the diarrhoea and associated symptoms, while neomycin-sulphonamides, though reducing the associated symptoms, did not affect the diarrhoea.

The incidence of diarrhoea was significantly less in the Streptotriad group, and was confirmed by statistical analysis ($\chi^2=11.86$, $\eta=4$, $P<0.02$). Though the incidence of diarrhoea was slightly higher with neomycin-sulphonamides than with placebo there was no statistical difference between them.

Among those in whom the length of attack was known, it lasted one day in 33.8% and no more than three days in 75.2%. This duration confirms Gordon's (1965) description of traveller's diarrhoea. The participants who had three or more stools on the third day were significantly fewer in the Streptotriad group.

The results confirm the description of Gordon in that out of 186 patients having diarrhoea, 64 had abdominal pain, 39 felt tired, 27 lost appetite, 27 had nausea, and 26 vomited. Few patients thought they were febrile. The total incidence of associated symptoms was significantly and statistically less with both active tablets than with the placebo.

Other common symptoms of travellers overseas were also noted: constipation, colds, sore throats, and mouth ulcers. Approximately 10% had constipation; this was mostly ascribed to taking the tablets, but the incidence was slightly higher among those receiving the placebo. The constipation was almost certainly due to the upset of the circadian physiological rhythms associated with long-distance flights.

The incidence of diarrhoea related to territory emerges as follows: Africa 25.9%; Middle East 23.5%; South Europe 16.9%; North and Central Europe 15.6%; Asia (including India and Pakistan) 15.4%; South America and Caribbean 12.6%; Australasia 11.3%; North America 7.7%. The one surprising result is the low incidence in India and Pakistan.

Adverse Reactions.—Twenty-five persons stopped taking the tablets because of suspected reactions, 21 within five days and four within 10 days. Fourteen were thought to be unconnected with medication (seven were placebo reactors). Of the 11 prob-

ably connected, most occurred in the neomycin-sulphonamides group; five developed rashes, and six developed diarrhoea which cleared after stopping the tablets. There were two reactions reported with Streptotriad, but these were thought to be unconnected.

Discussion

Though traveller's diarrhoea is not a serious illness it can be incapacitating, especially to the business man carrying out extensive air travel within a tight schedule. A three-day stay in an overseas capital to collect the year's export orders could be completely lost. The plan, therefore, was to try to find a prophylactic agent which would be effective in reducing the incidence of this complaint and at the same time to obtain further information regarding incidence, associated symptoms, and geographical distribution.

Since the termination of the survey, frequent requests have been received for further supplies of tablet C (Streptotriad).

In view of the finding by Kean and Waters (1958) that 63% of cases of diarrhoea occur during the first week, it might be advisable to double the suggested dosage in the first week only.

Summary

This report describes a comparison of Streptotriad with neomycin-trisulphonamides and a placebo in the prophylaxis of traveller's diarrhoea involving about 1,100 B.O.A.C. personnel and families taking trips abroad. Medication was randomly allocated and given for three weeks, one tablet twice daily for the first two weeks while away and one daily for the third week. Children under 12 were given half dosage. The commonest places of occurrence were Africa (25.9%) and the Middle East (23.5%).

Streptotriad was statistically beneficial in reducing both diarrhoea and associated symptoms. Neomycin-trisulphonamides was statistically beneficial in reducing symptoms, but not diarrhoea; abdominal pain was the commonest associated symptom: 75% had a duration of three days or less. Adverse reactions were practically nil with Streptotriad, which was by far the most popular medication as noted by the number of subsequent requests.

In view of Kean's work it might be worth considering whether the dosage of Streptotriad should not be doubled during the first week.

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