solutions (three times isotonic) of either glucose or saline will bring on the dumping symptoms; but hypertonic saline causes less severe symptoms than glucose, with much less weakness and smaller electrocardiographic changes and does not produce the usual fall in serum-potassium (figs. 6 and 7 and table). Abnormally rapid absorption of carbohydrate is a feature of these patients (Smith et al. 1951); this will lead to an unusually rapid deposition of glycogen, associated with intracellular binding of potassium and lowered serum-levels of potassium and inorganic phosphate (Harrop and Benedict 1923, Kendall 1938). Thus there may be a lack of available potassium in the serum as a result of its movement to glycogen-storing cells after the rapid absorption of carbohydrate.

Since the dumping symptoms can be reproduced by the introduction of food direct into the jejunum, and since rapid entry of food into the jejunum is common to the several operations that predispose to dumping attacks, it seems that the operations most likely to be followed by dumping symptoms are those which seriously impair the reservoir and diluting functions of the stomach.

**SUMMARY**

Six patients subject to severe dumping attacks—four after partial gastrectomy, one after total gastrectomy with oesophagojejunostomy, and one after vagotomy—have been studied before and after standard meals.

During dumping attacks there was shown to be an abnormal fall in serum-potassium, electrocardiographic changes characteristic of potassium deficiency, and electromyographic evidence of impaired function of voluntary muscle, indicating a postprandial lack of available potassium in the blood-serum.

Potassium injected intravenously did not prevent the dumping attack but prevented the usual muscular weakness and reversed the electrocardiographic changes, and terminated the attack prematurely.

It is suggested that two mechanisms contribute to this potassium lack—(1) the release of some adrenaline-like substance into the blood, and (2) unduly rapid absorption of ingested carbohydrate, leading to rapid deposition of glycogen and binding of potassium inside the glycogen-storing cells.

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sea conditions, and "crossing over" further reduced the risk of such errors.

**MATERIAL AND METHODS**

**Subjects**

68 soldiers were used who had volunteered from various Army units in England, Scotland, and Wales. Their ages ranged from 18 to 42, but 52 (76.5%) were aged 18–21. There were 51 private soldiers (or equivalent rank), the others being non-commissioned officers. 46 of them were on National Service and 22 were regular soldiers. All branches of the Army were represented. Preliminary questionnaires gave the following information about previous exposure and experience of motion sickness:

- 38 men (56%) had never sailed in a rough sea, seldom or never flown, and had never motion sickness.
- 13 men (19%) had either sailed in rough seas or often flown without becoming sick.
- 7 men (10%) had been exposed to seasickness or airsickness and had become sick.
- 10 men (16%) were regarded as very susceptible to motion sickness either because they became sick in a calm sea or because they were both often sick at sea and had other forms of motion sickness. (The men's own assessments of a rough sea may have been influenced by whether they were seasick or not, but the purpose of this questionnaire was to find out whether there was a predominance of those who believed themselves to be particularly susceptible or resistant to motion sickness.)

It may be concluded that a fairly representative sample of the Army's lower ranks had volunteered for this experiment.

**Drugs**

To avoid entirely arbitrary dosage it was decided to use each drug in the largest dose which, according to published reports, was certain not to cause undesirable side-effects. The drugs were given in indistinguishable capsules.

- Phenergan: 25 mg.
- Avomine: 25 mg.
- Dexamethasone: 4 mg.

The ships left harbour at noon, 1½ hours after the drugs were taken, and it always ceased within another 2 hours. Identical or very similar sister ships were used.

**Wasted Trips**

Only the results of four successive trips carried out according to the above plan are given below. Twice during the previous week, however, the men were asked to underline whichever answer was true. Space was allowed for remarks.
to these craft, and their activities, the grouping, and the timing could not be controlled according to the experimental plan. The findings, however, in no way contradicted those reported below. The first attempt to do the test in fast patrol boats was also a failure because, in spite of a weather forecast to the contrary, the sea was calm and no amount of seamanship could produce adequate motion. These wasted trips, however, eliminated any apprehension or overexuberance the men may have had before the experiment.

**Boat Motion**

A record of the sea conditions and the boat motion is given in table I. By varying the speed of the boats it was possible to obtain very similar degrees of movement over a wide range of sea conditions. Records of vertical acceleration were taken at short intervals with a Dobbie McInnes recording accelerometer placed amidships in the centre of the forward mess deck. Occasional peaks of about 1 g were obtained in all trips, and these were particularly frequent in one test (March 14, 1951), when there was also some horizontal "rolling." Most of the men receiving a dummy substance were sick on that day (see below).

**Non-starters**

One man who had been very sick throughout the tests (except when he had had hyoscine) asked to be excused before the last run and was allowed to return to his unit. Another man was absent on one day because he had to attend a court of inquiry, and a third man missed one trip because of a bad toothache. It is unfortunate that all 3 men happened to miss the day when they should have taken phenergan.

**RESULTS**

**Vomiting**

Table II shows that after hyoscine hydrobromide only 2 of the 68 men vomited, whereas more men did so after phenergan and benadryl. About half the men vomited after the placebo. If the results are worked out to show the proportion of susceptible men who were protected by any particular substance (Holling et al. 1944), hyoscine hydrobromide protected 94% of those who might otherwise have vomited, while phenergan protected 61% and benadryl 44%. The 3 men who did not have phenergan could not have altered the figure for that drug outside the range of 58–64%.

The $\chi^2$ distribution with a correction for continuity (Fisher 1934) was worked out for all possible comparisons between the effects of any two substances, and the results are shown in table III. The differences between the number of men who vomited after hyoscine hydrobromide and the number of men who vomited after any of the other substances were highly significant, and so was the difference between the number of men who vomited after phenergan and the number of men who vomited after the placebo. The difference between the numbers vomiting after benadryl and after the placebo was significant, but the difference between the numbers vomiting after benadryl and phenergan was not significant.

About 80% of those who vomited after phenergan and the placebo, and both men who vomited after hyoscine, began to do so within 30 minutes of reaching rough seas, but only 60% of those who vomited after benadryl did so during the first 30 minutes. This observation, however, does not justify any definite conclusions about the effect of these drugs on the time of onset of vomiting.

**Nausea**

Some men who did not vomit stated on the questionnaires that they felt sick. The results are shown in table II. Among those who did not vomit, phenergan seems to have given better protection from nausea than hyoscine or benadryl. If vomiting and nausea are considered together and the proportion of those protected is worked out according to the method of Holling et al. (1944), hyoscine protected 77% of those who might have felt or been sick, phenergan 65%, and benadryl 30%. (The correct number of those protected by phenergan must lie between 63 and 67%).

Table III shows that, as regards the number of men who vomited or felt sick, there was a highly significant difference between hyoscine and benadryl and between hyoscine and the placebo. The difference between phenergan and the placebo was also highly significant, while the differences between benadryl and phenergan, and benadryl and the placebo, were significant. The number of vomits among those who were sick was not affected by previous medication. On one day, when there were more vertical peaks than usual and some "rolling," all but 3 men receiving the placebo were sick. 8 men each vomited after phenergan and benadryl, but only 1 after hyoscine.

Answers given in the questionnaires tallied with the observers’ records of those who vomited.
The findings on the day when most men receiving the placebo were sick bear out this view but do not allow definite conclusions. Hyoscine did not prevent nausea with equal success, and, if nausea and vomiting are considered together, the apparent superiority of hyoscine over phenergan was not statistically significant. Since, however, for those affected the choice lay between feeling sick without vomiting or feeling sick and vomiting, there can be no doubt that hyoscine would be preferable. Subjective answers bear this out.

It can be concluded also that all three drugs in the present doses were remarkably free from side-effects. It seems that headaches, dry mouths, giddiness, and drowsiness are all symptoms of seasickness which are present in a large number of untreated men (table IV), and that these symptoms can be made a little worse or a little better by the drugs used. Hyoscine hydrobromide 1 mg. caused a feeling of dryness of the mouth in most subjects, but hyoscine should not be condemned on that account alone, especially since nearly half the men had that symptom after being given a dummy substance.

It was pleasing to note that the men's own assessment of their symptoms and their preferences conformed with objective observations, but this does not mean that it is safe to rely on subjective data alone. The large number of preferences expressed for the placebo shows that users' opinions on seasickness remedies can only give a rough idea of their efficacy.

It cannot be said how effective benadryl would have been in larger doses, but there is no reason to believe that the main conclusions of the present experiment would have been different if more bendaryl had been given, because both 50 mg. of benadryl and 100 mg. of dramamine have been found to protect fewer people from airsickness than 0·65 mg. of hyoscine (Chinn and Oster 1950, Strickland et al. 1950, 1951). The superiority of phenergan over benadryl may in part be a result of its greater central depressant or 'hyoscine-like' action, to which the effectiveness of anti-histamine drugs against motion sickness is probably due (Burn 1950, Bain 1951). Future tests will have to show whether the present results can be modified by different dosage.

**SUMMARY**

A controlled and crossed over experiment was made at sea in which 68 men were in turn given 1 mg. of hyoscine hydrobromide, 25 mg. of benadryl (diphenhydramine hydrochloride), 25 mg. of phenergan (promethazine hydrochloride), and a dummy substance. 96% of those who might otherwise have vomited were protected from vomiting by hyoscine, 61% by phenergan, and 44% by benadryl.

If nausea and vomiting are considered together, hyoscine protected 77%, phenergan 65% and benadryl 30%.

Except for the difference between the numbers vomiting after benadryl and phenergan, and the difference between the numbers suffering from nausea and vomiting after hyoscine and phenergan, the differences were statistically significant.

All drugs were remarkably free from undesirable side-effects in the doses given.

**DISCUSSION**

The present findings strongly confirm previous observations that hyoscine hydrobromide effectively prevents seasickness in a large number of people, and that, at any rate in fit men, 1 mg. is a safe dose. Hyoscine, moreover, seems to be even more effective than previous trials have suggested (Holling et al. 1944, Hill and Guest 1945, Tyler 1946, Chinn et al. 1950). The difference may in part be due to the fact that some previous experiments did not separate those who vomited from those who felt sick, and that smaller doses of hyoscine were used in other experiments. The fact that efforts to eliminate subjective and accidental influences were more stringent in the present experiment than in previous ones and that every man was given each substance may, however, have contributed to this difference. Possibly the best effect of hyoscine is evident in small craft when the period of motion is short and the incidence of seasickness high.
PATIENTS with arthritis always command sympathy and attention. Sufferers from other forms of rheumatism receive less heed, because they have little to show for their pains and discomforts. Too often they are denied the dignity of a diagnosis; or their disorder may be termed "psychogenic rheumatism," so that they do not get the treatment that would bring them a fair measure of relief. Yet at clinics for rheumatic diseases patients with non-articular rheumatism are in a majority; and this large group deserves serious consideration.

To W. S. C. Copeman and his associates must go the credit for focusing attention on the various syndromes which come under the heading of non-articular rheumatism. Panniculitis (to be clearly distinguished from the skin disease of that name) is one such syndrome that is commonly overlooked. It is, however, worth recognising since it can give rise to a curious array of disturbing and distressing symptoms.

**THE CLINICAL SYNDROME**

The condition is common at the menopause, whether natural or artificial, probably for two reasons: (1) at this time there is often a rapid increase in weight; and (2) there is also a readjustment in endocrine function. The syndrome can, however, occur in quite young people, though this is less usual. It can also develop without associated rapid increase in weight; but this is very uncommon.

The patient's added bulk may be evenly distributed, but commonly certain areas of the body are more affected than others. The areas usually involved are in the region of the deltoid muscles, the back of the upper arm, the back of the neck, over the pectoral muscles, the lumbar region over the sacrum and the buttocks, the front and outer side of the thigh, the front of the lower leg, and at times the region of the heel to either side of the achillis (see fig. 1). For diagnosis a convenient spot to examine is in front of the external auditory meatus, in the region of the parotid gland; of my series of cases 70% showed the characteristic thickening in this position.

Fig. 1—Areas of body most commonly affected by panniculitis.

The patient complains of a feeling of weight or heaviness in the affected parts, giving rise to undue fatigue on exertion. When the added bulk is in the lower limb and the gluteal region, she is exhausted by walking; when the arms and neck are involved, work requiring lifting of the arms—as in polishing, typing, or even the simple act of brushing the hair—can cause fatigue, heaviness, and aching discomfort. In addition, the patient complains of a sore, bruised, or burning feeling when the affected parts are warmed—for example, before a fire or in bed at night. In bed this symptom is one cause of "rigidity," for the patient restlessly seeks out cool areas in the bed. The pain is usually felt in patches or areas of the body; and after being for a time in one spot—for example, the front of one thigh—it may spread to a similar position in the other limb, or to another area of the body. In addition to pain, there may be patches of numbness and a sensation of pins and needles; and when such paræsthesiae are bilateral they can easily give rise to difficulty in diagnosis. One of my patients had a patch of numbness on the outer side of one heel which remained relatively insensitive to pinprick for fully three weeks, after which sensation gradually returned; she was most conscious of the altered sensation when in a hot bath. Panniculitis may cause another curious symptom—the patient says that she has an area of the body which she "cannot get warm," even a hot-water bottle bringing no comfort to the cold patch. These patients also bruise easily; and this may first lead them to seek advice. Finally, they notice that the skin no longer perspires so freely.

**Signs**

With this syndrome two main signs are found. First, the skin is tacked down over the affected part so that it is impossible to lift it away from the underlying tissue, and motting or a peau d'orange effect is produced when the skin texture is tested by palpation. Second, over the affected area the skin feels dense, almost indurated, with a lack of elasticity; one of the easiest areas in which to elicit this sign is in front of the external auditory meatus. Many of the indurated areas may be tender on palpation; the tissues feel