A CASE OF SYPHILIS OF THE LUNGS

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The scarcity of recorded cases of syphilis of the lungs may partly be due to the infrequency with which it is recognised and the belief that antemortem diagnosis cannot be established. The object of publishing this case is to show that a diagnosis can be arrived at during the patient's life and to help in establishing clinical data on which a diagnosis can be made.

A widow, aged 54, was asked to attend a clinic under the tuberculosis scheme because she had been notified as suffering from "tuberculous disease of the malar bone." Her occupation was domestic duties. In April 1935, she noticed a swelling over her left leg in 1927 she had always been healthy until 1936, when she began to suffer from cough, with small amounts of sputum streaked from time to time, lassitude and dyspnoea. Dyspnoea had only become pronounced during the previous few months, when her duties had become too much for her. She had a tempo-facial nerve, no forgetfulness or miscarriages. Her husband died in 1919 at the age of 37 from "growth on the brain." First sought medical advice for a swelling over the left tempo-facial region which developed in 1937 and for which she received treatment from her doctor for 8 months. The swelling was excised at the local hospital in January, 1938, but a chronic discharge persisted until December, 1938. About this time she developed a similar swelling over the left malar bone which was incised at the same hospital in November, 1938.

At her first attendance at the clinic on March 2, 1939, the lower of the two incisions was weeping slightly while the upper had healed completely. Weight 8 st. 5½ lb.; best known weight 10 st. The chest was symmetrical. Some restricted movement of the left upper half where the percussion note and air entry were impaired but no adventitious sounds were detected. Apex-beat in normal position. Heart sounds normal. B.P. 145/95 mm. Hg. Pulse-rate 70 per min., regular. Mentality and memory good. Pupils equal and reacted to light and accommodation. No objective sensory changes. Complained of pain over left femur not unlike tabetic pains. No rombergism. Tendon reflexes normal. Healed ulcer with tissue-paper appearance over the upper end of left fibula. No tubercle bacilli found in sputum (no further examinations made because cough had gone by next attendance).

Blood Wassermann and Kahn reactions + +. Radiogram of chest on March 2 (fig. I, plate): arch of aorta slightly prominent and contains a calcified plaque. In the upper zone there is a large opaque area in radiolucency, which may be the true cause of the lesion was suspected. She attended a local treatment centre—and still continues to do so, for her Wassermann and Kahn reactions are still positive. She was asked to attend for X-ray examination fortnightly for 6 months, and her second attendance was not until April 20, 1939, when the film (fig. II) already showed considerable absorption of the opacities originally noted. Her symptoms, too, were much improved; she could do a day's work and walk upstairs without undue dyspnoea; her cough had disappeared; the sinus over her left malar bone had healed. Further radiograms showed progressive improvement. At her last attendance on Jan. 20, 1941, she was in "better health than ever" (fig. III). Despite "winter colds" there is no persistent cough. Weight 8 st. 10 lb.

This appears to be a case of the gummatous form of lung syphilis. The criteria on which the diagnosis is based are:

1. Length of history.
2. Positive serological findings.
3. Absence of tubercle bacilli in sputum.
4. Prompt relief of symptoms and progressive, rapid and maintained improvement in X-ray appearances following antisyphilitic treatment.
5. Presence of syphilitic lesions elsewhere.

I should like to thank Dr. T. W. Stallybrass, the county M.O.H., for permission to publish this case, and Dr. T. V. Cooper, the county pathologist, for the laboratory investigations.

ACTION OF BISMUTH CARBONATE IN GASTRIC DISEASE

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The gastric antacids and sedatives constitute an important group of therapeutic agents, and it is comparatively easy to confirm their effectiveness. In certain kinds of gastroduodenal disease temporary relief of pain can commonly be obtained. There is a high proportion of cases. The action of these compounds on the pH of the gastric contents can be demonstrated by observations made in the course of fractional test-meals.

Bismuth carbonate and bismuth subnitrate are included in this group of drugs. The employment of these basic salts of bismuth dates from the use of the subnitrate by Odier in 1803. It is noteworthy, however, that he used this salt in doses of only one grain and always prescribed with it magnesium (gr. 10) and sugar (gr. 10). Odier thought this compound powder an infallible remedy for grippe, and since then bismuth preparations have enjoyed a vogue in the treatment of gastroduodenal lesions. MacKenna (1891), in a paper on the history of bismuth, mentions that in 1852 Chambers in England, and Kussmaul in Germany, advocated bismuth salts in the treatment of gastric ulcer; Kussmaul recommended the subnitrate in doses of 10–20 grammes daily. In recent years bismuth subnitrate has fallen into disrepute, after the publication of a number of cases of nitrite poisoning attributed to the reduction of the nitrate by intestinal bacteria. Bismuth carbonate, on the other hand, is widely used in the treatment of gastroduodenal disease, especially in cases of peptic ulcer and gastritis. According to MacKenna and Williams (1931), Poulsson 1940, Dilling 1940) this insoluble salt acts as a protective in much the same way as a...
The feebleness of the antacid action on gastric juice is made by his collaborator Dr. P. J. Briggs, states that however, describing a series of radiological observations made on an empty stomach does not as a rule adhere to dusting powder soothes an irritated skin. Hurst (1929), "minute. They also tabulate their conclusions regarding the powerful antacid magnesium hydroxide (fig. 1). In all, 9 patients were investigated by means of fractional test-meals, using half-drachm doses of bismuth carbonate. It was found that the acidity was unchanged or continued to increase in 7. In 2 who had very low acidity (corresponding to 10 and 20 c.cm. N/10 NaOH respectively) the curves fell to zero after the administration of the drug. That these failures were spontaneous rather than the effect of the bismuth carbonate is suggested by the fact that the addition of an excess of bismuth carbonate to gastric juice in vitro never reduced the acidity by more than 10 c.cm. N/10 HCl%.

The effect of administering a single large dose of bismuth carbonate was also studied. Two fractional test-meals were performed on a healthy medical student. During the first he received an average dose (gr. 15). It will be seen (fig. 11b) that the fall in the gastric acidity was comparatively small. Indeed the curves reveal that spontaneous alterations were greater than the change attributed to the action of the bismuth carbonate. On another occasion he was persuaded to take a very large dose (gr. 210). The effect on the gastric acidity was more impressive (fig. 11c) but it lasted only half an hour. My colleague Mr. J. B. Pettigrew estimated the hydrogen-ion concentration of the samples electrometrically and found that the change was comparatively small (pH 1.67 to pH 2.16). The bismuth carbonate and bismuth oxychloride which were present in all the samples of gastric juice appeared to have caused the mucus to form curd-like masses. Astringent action.—The in-vitro experiments of Freezeer, Gibson and Matthews referred to show that, although the addition of bismuth carbonate to weak hydrochloric acid raises the pH the reaction of the mixture never approaches neutrality. My own observations were made using open test-tubes instead of the closed apparatus described by these workers, but the results were substantially the same. A quantity of bismuth carbonate (B.P.) weighing 1.5 g. was shaken up in a wide tube with 15 c.cm. of distilled water, and 15 c.cm. of N/10 hydrochloric acid (pH 1) was then added. The mixture was filtered and the pH of the filtrate was found to be in the region of 3.5. The same result was obtained when similar mixtures had been allowed to stand for intervals ranging from 1 to 10 minutes. Hydrogen-ion concentration was determined by means of chemical indicators and the Lovibond comparator and results are reported as being only approximate. These rough estimations of the neutralising power of bismuth carbonate on decinormal HCl were carried out merely as a preliminary to similar observations on gastric juice. It was found that the addition of an excess of bismuth carbonate to gastric juice in vitro produced only slight changes in acidity, as is shown by the following example:—

<table>
<thead>
<tr>
<th>Decinormal HCl c.cm.</th>
<th>% FreeHCl</th>
<th>Total acidity</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before addition of bism.</td>
<td>40</td>
<td>55</td>
<td>2</td>
</tr>
<tr>
<td>After excess bism. carb.</td>
<td>32</td>
<td>50</td>
<td>2.1</td>
</tr>
</tbody>
</table>

The feebleness of the antacid action on gastric juice is probably partly due to the buffering effect of mucoprotein.

The third method of investigation consisted in making observations during fractional test-meals. In any individual, however, day to day variations in fractional test-meal results are so considerable that experiments of this type necessarily lack controls that are completely satisfactory. The nearest approach to obtaining adequate control readings consists in using the first three or four of a series prior to the administration of the drug under investigation. Although this method is imperfect, its value is increased when applied to a drug whose potentialities are already known from in-vitro experiments; and the negative results from bismuth carbonate are more convincing when compared with the effect of the powerful antacid magnesium hydroxide (fig. 1).
Egg albumin was used to demonstrate the acrosolony of dilute solutions of bismuth carbonate, because the protein was readily produced by a 0-05% solution of tannic acid.

The solubility of bismuth carbonate in gastric juice was investigated on 12 patients; the total acidity ranged from 10 c.cm. to 56 c.cm. N/10% and the free hydrochloric acid from zero to 48 c.cm. N/10%.

The mixture was shaken and set aside for a few minutes. It was then filtered and the filtrate was found to have a pH of 1-1. The residue was washed with distilled water until free of hydrochloric acid—that is, until the washings failed to give a precipitate with silver nitrate, and in this form the residue was dissolved in nitric acid. About 5 c.cm. of the nitric acid filtrate was tested for chloride by means of silver nitrate. A heavy white precipitate formed, proving that abundant chloride was present in solution. As a blank bismuth carbonate was dissolved in nitric acid; this solution gave no precipitate with silver nitrate.

Radiological findings.—Seventeen observations were made on 12 patients; 2 of whom had large penetrating ulcers (about 1-5 cm. in diameter) situated on the lesser curvature as in fig. VI. When there was food in the stomach at the pylorus during the early stages of emptying of the stomach, a black line could be clearly traced into the stomach, but the stream was soon broken up into several smaller streams. The pylorus during the early stages of emptying of the stomach is continuous; although five meals had been taken during this time, the constriction was not permanently altered; with the resumption of the erect posture the distribution of the bismuth carbonate was even over the surface and forms a continuous sheet evenly over the whole lining of the stomach; and no evidence was obtained for Cushny's (1941) statement that bismuth carbonate is "later distributed evenly over the surface and forms a continuous sheet over any ulceration." By manual palpation and alteration of the patient's posture the distribution of the bismuth carbonate was not permanently altered; with the resumption of the erect posture the pool immediately reappeared in the original position. Repeated efforts to fill the large ulcer crater with the bismuth carbonate followed by manual palpation were fruitless.

Nine of the patients were investigated to discover the effect of taking a meal about half an hour after a dose of bismuth carbonate. They received 2 g. (gr. 30) of the salt about half an hour before breakfast and a radiological examination was made 2 hours later. In 5 of this series there was no sign of the drug; apparently it had mixed with the foodstuff, and carried out through the pylorus during the early stages of emptying of the stomach. In the remaining 4 patients a variable amount of the drug had been retained at pylorus; it was apparently confined to the prepyloric region of the greater curvature as in fig. VI. Complete disappearance of the salt was accelerated by the taking of more food. In one patient vomiting persisted for at least 8 hours although five meals had been taken during this time (fig. VII). When there was food in the stomach at the time of administration of the drug, the suspension of bismuth carbonate was seen to follow the usual course, and when it had been broken up into several smaller ones by the food masses, and the bulk of the salt accumulated about the middle of the body of the stomach. The drug gradually dispersed and became intimately mixed with the gastric contents (fig. V).

There were 21 male patients admitted to a medical ward of Stobhill Hospital on account of abdominal pain thought to be associated with abnormalities of the stomach or duodenum. After the usual clinical examination the patients were given irrigations radiologically; after the transmitted test-meal was done, and the stools were tested for occult blood. The patients were given the ordinary ward diet. Each patient was then presented with a batch of 18 large powders; 6 were bismuth carbonate, 6 were coloured with a trace of azorubrum (B.P.C.); 6 were composed of lactose, the quantity (gr. 40) having a similarity to the bismuth carbonate powders, and these were tinted with methylene-blue; 6 were made of dried milk, which was beige in colour.

The choice of substances that can be used as controls is very limited. Many compounds which are inert when applied externally act as adsorbent antacids in the stomach. Lactose appears to be the only substance, easily obtainable, which is entirely satisfactory. Milk is an antacid, neutralising its own volume of gastric juice (Frellon et al. 1927). Although dried milk must be regarded as an antacid when adequate quantities are used. In doses of about gr. 30, however, this effect is hardly likely to be appreciable. This view is supported by the results of the present investigation, and milk powder in small doses was regarded as an inert substance and was accordingly used as an additional control.

The patient was directed to take the powders in any order and to decide in the course of a week or ten days which of them, if any, gave relief from pain. It was emphasised that he must not take a powder unless he received it as directed and it was given to relieve pain, and relief he was to wait for half an hour before trying one of the others. Effects other than the action on pain were ignored. The composition of the powders was not disclosed to the patients, or to the nursing staff with the exception of the powdered tannic acid. The patients were directed to only by colour. The group of patients was not selected except in so far as it was found necessary to abandon the investigation in a few patients who were not sufficiently intelligent to cooperate satisfactorily. No precautions were taken to prevent conversation between patients who were receiving treatment with the powders at the same time. The patients' descriptions of the effects of the powders were roughly classified as (a) no relief; (b) doubtful; (c) definite relief; (d) pronounced relief. The last two were considered to be significant.

In 16 patients there was objective evidence of disease: duodenal ulcer or scarring 10; gastric ulcer 2; gastritis 1; gastric spasm 1; simple hyperchlorhydria 2. In 5 patients no signs of disease were discovered. The answers are summarised in the following table: several of the patients reported relief from more than one powder, and therefore the number of answers exceeds the number of patients.

<table>
<thead>
<tr>
<th>Whole series</th>
<th>Disease proved</th>
<th>Disease not proved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relief from—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pink powder (bism. carb.)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Blue powder (lactose)</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Yellow powder (dried milk)</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Unrelieved by any powders</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Among the 6 patients who appeared to get relief from the bismuth carbonate, 4 were also relieved by taking lactose or dried milk, and 2 experienced no relief from either of these pharmacologically inert powders. None of the patients said that the three powders gave equal relief.

Eight of the patients, after completing the course of treatment with the bismuth carbonate, were given a similar opportunity, but of course six were given the coloured powders. The pains were amenable to treatment by a drug which is known to have a powerful antacid action. Six of these reported immediate relief from pain, and the benefit far exceeded any that had been obtained from the coloured powders. It is noteworthy that lesions of the stomach or duodenum had been demonstrated in all of these 6 patients: in the other 2 patients no disease had been
discovered, and neither of them benefited from the magnesium hydroxide.

These results were examined statistically by Dr. Richard A. Robb of the mathematics department in the University of Glasgow, and his findings may be summarised as follows.

The effects of the inert powders (lactose and dried milk) is shown by contingency tables where the 21 patients are classified according as they have or have not disease, and according as they do or do not get relief from the powders. As is to be expected, the classifications are independent, using the $X^2$ test; that is to say, there is no evidence that the powders were of any value. The distribution of the figures indicate that there was no difference in the results obtained from bismuth carbonate again shows that the classifications are independent—the response of the patients was the same as when the inert powders were used.

It was considered necessary to distinguish between the degrees of relief obtained from the treatment, so that further analyses of the data were made. Again the figures indicate that there was no difference in the response of the patients to the three powders—bismuth carbonate, lactose and dried milk. If the 5 patients with no evidence of disease are excluded from the series and the analysis confined to those known to be suffering from gastro-duodenal disease, the results are the same.

**DISCUSSION**

The investigations provide no evidence in favour of the view that bismuth carbonate in therapeutic doses is a reliable means of protecting the gastric mucosa. After administration of the powder, it is evident that it collects in the most dependent part of the stomach and there is a tendency for it to adhere to the mucous membrane in a relatively small area in the prepyloric region; but the ulcer-bearing area of the stomach is rarely affected.

Bismuth carbonate has an astringent action on the empty stomach, but the investigations show that even under favourable conditions this must be very slight; and in practice it must be rendered negligible by the combination of the minute amount of bismuth in solution with the mucoproteid of the gastric contents. It is clear that when a gastric astringent is required other drugs offer a much more reliable method of treatment—e.g., tannic acid in the form of glycrrin of tannic acid (B.P.).

Previous workers have shown that the chemical properties of bismuth carbonate make it an unsatisfactory antacid for clinical purposes, and this conclusion is confirmed. The antacid effect following therapeutic doses of bismuth carbonate is seen to be trivial or entirely absent. Although very large doses have produced appreciable changes in gastric acidity, even these are transient, and the side effects of such large quantities, especially constipation, cannot be disregarded. There seems therefore to be little justification for the view that bismuth carbonate is a valuable adjuvant to the so-called antacids such as magnesia. The negative results obtained in test-meals are in keeping with the conclusions drawn from the therapeutic trials in patients suffering from gastro-duodenal disease, when it was found that bismuth carbonate was more valuable than powdered milk or lactose in relieving pain. The findings from the whole support the view expressed by Hurst (1929): “It seems very improbable that the small dose of bismuth [carbonate] given with sodium bicarbonate in the usual alkaline mixture would be at all effective in any kind of ulcer, and its use should therefore be discouraged, as it has the disadvantage of making the stools black so that the immediate recognition of slight melena by the patient becomes impossible.”

**SUMMARY**

The action of bismuth carbonate as an antacid was investigated in vitro, and also by fractional test-meals in healthy and ulcer subjects. Therapeutic doses were found to have only a negligible effect on gastric acidity. Hydrochloric acid or lactic acid of the strengths found in the stomach dissolve only a trace of bismuth carbonate. Such solutions were found to have no astringent action on egg albumin.

In 12 patients who were screened after taking doses of bismuth carbonate the drug formed a pool at the most dependent part of the stomach, and showed no tendency to distribute itself over the lining of the stomach or to fill the crater of an ulcer when one was present.

Three powders consisting of bismuth carbonate, lactose and dried milk respectively were given to 21 patients complaining of abdominal pain thought to be due to abnormalities of the stomach or duodenum, and they were asked to say which powder relieved their pain. No significant difference was found in the pain-relieving effects of the three powders. Six of the patients with demonstrable disease of the stomach were then given magnesium hydroxide; all of them reported much greater relief than from any of the powders.

It is concluded that in therapeutic doses bismuth carbonate has a negligible effect as an antacid or as an astringent dressing for the gastric mucosa, and that it is of no value for the relief of pain in gastroduodenal disease.

A desire to thank Prof. Nasor Morrisey for his interest in this work, Dr. David T. Gibson, D.Sc., of the chemistry department in the university, and Dr. W. D. C. McCrorie, assistant radiologist at Stobhill Hospital, for advice and criticism; and Sister H. D. Collins and Sister J. E. Rennie for their cooperation.

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**BLAST INJURY OF THE LUNGS**

J. N. O'REILLY, D.M. OXFORD, M.R.C.P.
S. ROODHOUSE GLOYNE, D.M. OXFORD, M.R.C.P.
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MEDICAL SUPERINTENDENT OF PATIENTS AT ST. MARGARET'S EMERGENCY HOSPITAL AND TO THE LONDON CHEST HOSPITAL

MUCH attention has been given lately to the effects of the blast of high explosive on people in the immediate neighbourhood. Apart from its scientific interest a careful study of the subject is of great importance in deciding correct treatment, and we are therefore recording our experiences in the treatment of a series of cases of men suffering from blast injuries of varying severity.

On Nov. 18, 1940, a high-explosive bomb dropped close to our fair ground. There were about 2000 people in the neighbourhood. Apart from its scientific interest a careful study of the subject is of great importance in deciding correct treatment, and we are therefore recording our experiences in the treatment of a series of cases of men suffering from blast injuries of varying severity.

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