TESTING FOR OCCULT BLOOD IN FAECES.

A STUDY OF ALLEGED FALLACIES.

BY

A. G. OGILVIE, M.B., B.S.

(From the Pathological Department, Royal Victoria Infirmary,
Newcastle-on-Tyne.)

THE great clinical value of a reliable test for occult blood in the faeces is generally recognized, but there is divergence of opinion as to what constitutes a reliable result. A number of fallacies have been alleged to occur, the chief among them being due to diet, and until comparatively recently it was generally accepted that the tests were valueless unless performed under special conditions.

The great majority of British observers still hold this view. Coope,¹ Hurst,² Beaumont and Dodds,³ and others rigidly exclude from the diet all foods containing haemoglobin and chlorophyll for at least three days before the test, affirming that without such a precaution the tests are valueless. A notable exception to this is Maclean,⁴ who states categorically that such precautions are not at all necessary. No investigations of the question are, however, quoted by these authorities. Abrahams¹¹ found that it was necessary to take 1 c.cm. of blood by the mouth before any reaction was produced in the stools, on a diet free from haemoglobin and chlorophyll. This observation was the result of personal experiments carried out by himself and his assistant; it is quoted by Bennett,⁵ who nevertheless also holds the view that the diet must be rigidly controlled.

On the Continent, and especially in Germany, the problem has been studied on a more experimental basis. Koopman⁶ and Gregersen,⁷ after performing a great many tests, expressed the opinion that the pyramidon and benzidine tests as generally used are too delicate, giving a positive result where no pathological amount of blood is present, and Gregersen recommends a 0.5 per cent. solution of benzidine as likely to give more reliable results. He states that less than 1 in 3,000 to 1 in 20,000 of blood in the stools cannot be considered pathological. Gregersen and Adler,⁸ working independently, found that none of the non-meat foods, tested *in vitro*, gave a positive reaction, and Gregersen maintains that contamination in preparation alone is responsible for a reaction with foods containing chlorophyll. Boas,⁹ though he recommends the Gregersen test, nevertheless excludes meat, fish, and certain vegetables from the diet—for example, French fried potatoes. In America Aaron¹⁰ has used the Gregersen test, and heartily recommends it. All these writers, however, declare that, in order to obtain a reliable result, meat, and vegetables cooked in such a way as to include the possibility of contamination, must be excluded from the patient's diet for several days before a test. Other alleged fallacies that have been mentioned are bleeding from the gums, the use of hard tooth-brushes, sucking of the teeth, and iron medicines.

The object of the investigation here reported was to inquire into these "fallacies," and to bring the examination of the stools for occult blood within the scope of the busiest general practice equally with the examination of the urine for albumin and sugar. The large number of patients with carcinoma of the stomach first seen by a surgeon or physician at a general hospital in an inoperable condition, and the large number of patients suffering from gastric or duodenal ulcer who are first seen after the calamity of perforation, emphasize the importance of this. It was therefore decided to use only readily applicable chemical tests, and to select from among the many different chemical tests and methods two of the most reliable, in order the more readily to estimate the value of the results obtained. Spectroscopic tests are not well adapted for use in general practice; while, as almost every author uses a different chemical test or method, it was felt that any attempt to include them all and compare results would tend to confuse the issue.

The Tests Used.

Pyramidon.—A "button" of faeces is taken by means of a clean glass rod from the centre of the stool; it is important to take it from the centre, as no risk of contamination in the lower bowel—as from haemorrhoids—must be run. An emulsion is made in 5 c.cm. of distilled water, a few drops of glacial acetic acid

added, and the whole boiled. An inch of the cooled emulsion is then taken, and 16 drops of glacial acetic acid added; 1 c.cm. of a 5 per cent. alcoholic solution of pyramidon is poured gently down the side of the tube so as to form a clear layer on the top, and the same amount of hydrogen peroxide added in the same way. A deep blue colour should develop within fifteen seconds if the reaction is positive, and this is the standard used here in judging the results.

Benzidine (Gegersen).—Powders are made up containing 0.2 gram of barium peroxide and 0.025 gram of pure benzidine; if put up in wax papers they will keep indefinitely. Just before the test one powder is dissolved in 5 c.cm. of a freshly prepared solution (50 per cent.) of acetic acid. A portion of the faeces is taken as before and smeared on to a clean glass slide, and a few drops of the solution run on to the smear. A blue or blue-green colour develops within a minute if the test is positive, and the reaction is graded according to the depth of the colour and the time it takes to develop. Gregersen recognizes three grades: 1+, a pale blue or green colour within sixty seconds; 2+, a definite pale blue in twelve to fifteen seconds; 3+, deep blue within three seconds. These grades have been adhered to, except that a blue-green colour developing after thirty seconds has been labelled "Faint 1+" and regarded with suspicion.

PRINCIPLE OF THE TESTS.

The principle of these tests rests upon the fact that a colourless substance such as benzidine or pyramidon is oxidized by hydrogen peroxide, with the production of a blue colour, *only* in the presence of a carrier, such as haematin.

First Series.

As a preliminary an investigation of some of the common foods, cooked in the usual way, was carried out. This was not intended as a complete study, but for purposes of reference was thought to be sufficient. The foods used were meat, chicken, fish, egg, potato, cabbage, lettuce, and beef dripping. These were tested after ordinary methods of cooking (boiling, frying, and stewing), and also, in order to test the effect of "contamination in cooking," roasting and pickling in certain cases.

Only two foods cooked in the ordinary way gave any sort of positive result—namely, meat and chicken; and chicken gave no colour with the Gregersen test until after thirty seconds, and so may be disregarded as a source of confusion in the examination of the stools for occult blood. "Contamination in cooking" gave two interesting results, though otherwise negative. These were with meat and pickled herring. Roast beef gave an immediate reaction (3+) with Gregersen's test, as compared with a "2+" reaction with stewed mince, while pickled herring gave an immediate positive, as against completely negative results by other methods of cooking. Fried eggs, and the French fried potatoes, regarded by Boas as a potent source of error, were negative. Both roast meat and pickled herring are "basted" in the oven, the herring afterwards being pickled in vinegar; the basting would appear to have some bearing on the result. In this connexion it is interesting to note that dripping, whether beef or mutton, raw or fried, was negative to both tests. Vinegar is negative, but it is possible that the prolonged treatment with acetic acid, in the case of the pickled herring, may have some bearing on the result.

Second Series: Experiment on a Normal Individual.

A personal experiment was carried out in order to investigate the effect of ordinary articles of diet and certain methods of cooking on tests for occult blood in faeces; I considered myself normal in every way for the purpose in view. The experiment was continued for twelve consecutive days, the specimen being taken first thing each morning. The diet on these days was varied to include as many foods and methods of cooking as possible, the foods including bacon, beef, mutton, chicken, sausage, potatoes, and green vegetables. After three days on ordinary diet an entirely fish diet was taken—the fish being boiled, fried, and pickled—for three days. On the seventh day three ounces of raw meat, minced, was added to the ordinary diet, and on the eighth day two ounces of boiled ox-blood was taken. For the remaining days an ordinary diet, varied as much as possible, was taken, including on one day pickled herring again. The foods were roasted, boiled, fried, stewed, and pickled. All the tests were completely negative up to thirty seconds with Gregersen's method, and only one specimen gave a reaction after thirty seconds. This was on the first day's diet,

when a faint green colour appeared at fifty seconds. This was the only specimen which gave any reaction with the pyramidon also, and that a faint one. The diet on this day was fried bacon, roast meat, green vegetables, boiled potatoes, and fried sausages. "Contamination in cooking" might possibly have been a factor, but on subsequent days this risk was at least as great, especially on those days when pickled herring was taken, which, as stated above, gives an immediate deep blue colour with Gregersen's test. Three ounces of raw meat failed to give a positive result with either test, while the cooked ox-blood, which was taken in amount sufficient to give a definite reaction if uncooked (two ounces), also gave no reaction in the stools.

Thus it seems that meat, and especially underdone meat, may cause a green coloration after thirty seconds with Gregersen's test, and a positive result with the pyramidon test. The important conclusion indicated is that a blue or blue-green colour with Gregersen's test, obtained before thirty seconds, is proof positive of the presence of occult blood in the stools, irrespective of the patient's diet.

Third Series: Investigation of Thirty Pathological Cases.

Thirty pathological cases were investigated, all of the "fallacies" before mentioned being thus included; the cases were thought to be fairly representative of those found in the medical wards of a general hospital. All the tests were repeated.

Teeth-sucking and bleeding on brushing the teeth occurred in practically every case, but in spite of this fourteen out of thirty cases gave a persistently negative result (seven of them on full diet). Seven cases gave a faint coloration after thirty seconds (what has been called the "faint 1+" reaction); nine cases gave more definitely positive results. Of the seven patients who gave the "faint 1+" reaction, in five the diet could not be excluded as a possible cause; but in the two remaining—a case of chorea and a case of acute rheumatic fever—the bleeding could fairly be attributed to the alimentary canal. In the case of chorea the result persisted unchanged after all gum-bleeding had ceased and the diet had been strictly controlled, while in the rheumatic patient, although the diet produced a negative result, this appeared to be due to cessation of bleeding, as a subsequent full diet (roast meat, green vegetables, etc.) failed to reproduce the reaction.

Of the nine patients who gave more definite results, only five were taking any solid food whatever, and in four of these diet restriction produced no alteration in the tests. The fifth, a case of acute rheumatism, gave a "2+" reaction (blue in twelve seconds) and a definite pyramidon reaction; in this case it was unfortunately impossible to obtain a second specimen until too long afterwards to be of any value. The patient was, however, on a diet of boiled chicken and boiled fish, and a reference to the first series of tests will show that boiled fish is negative, while boiled chicken gives no result until after thirty seconds. It is inconceivable that such a diet could produce a stool giving a blue colour in twelve seconds. He had no gum-bleeding or carious teeth, contrary to the usual findings. Two out of the remaining four cases are interesting as illustrating Maclean's⁴ contention that milk diet tends rather to cause confusion by checking bleeding. These patients—cases of duodenal ulcer with recent melaena, who had large amounts of occult blood in the faeces—gave a negative result to both tests after four days on milk diet.

Gum-bleeding and Haemoptysis.

It is difficult to assess the importance of these symptoms as fallacies, owing to the variations to which they are liable, but the amount of bleeding should be taken into consideration. Slight bleeding may be discounted, as instanced by one case of Henoch's purpura, where persistently negative results were obtained in the presence of definite gum-bleeding; there were no other haemorrhages in this case, which was in a quiescent phase. In a case of chorea with slight definite gum-bleeding, the faintly positive result was still obtainable seven days after the bleeding had ceased; showing that the bleeding, though obvious clinically, was negligible in the stools. Two cases, one of bronchiectasis with haemoptysis, and the other of ankylostomiasis

(*Ancylostoma duodenale*) with gum-bleeding, gave results which it is impossible to exclude as fallacious. In these cases the bleeding was severe.

Iron Medicines.

Two patients with pernicious anaemia, who had been taking iron continuously for over three months, gave persistently negative results. Another case of pernicious anaemia was taking bone marrow, and this seems to illustrate a definite fallacy. The patient died soon afterwards, and at the necropsy no signs whatever of haemorrhage or erosion of the alimentary tract were discovered, although a "3+" reaction was obtained in the stools three days before death.

The Tests Compared.

On comparing the results obtained with each test one cannot fail to be struck with the greater delicacy of the pyramidon reaction. The pyramidon invariably gave a more definite reaction in cases where it was possible to differentiate. The more delicate a test, the less reliable is it for the purposes of clinical diagnosis, as positive results may be obtained where blood is not present in pathological amount. Thus it will be seen that the Gregersen test is the better adapted for clinical purposes.

Summary.

Certain of the common articles of food, cooked in various ways, have been tested; thirty pathological cases on various diets, and exhibiting all the alleged fallacies among them, have been investigated, and a personal experiment has been carried out. The results have been discussed, and the following conclusions have been arrived at:

1. The Gregersen reaction is more reliable than the pyramidon, but blue or blue-green colour must appear within thirty seconds to make the result conclusive.
2. "Basting" seems to have an effect in producing a reaction with foods, but frying has no such effect.
3. Bleeding due to hard tooth-brushes or teeth-sucking, and slight degrees of gum-bleeding and haemoptysis, may be disregarded, although severer degrees of bleeding may cause confusion.
4. Iron medicines produce no "occult blood" reaction in faeces, but the ingestion of red bone marrow is incompatible with a reliable test.
5. A blue or blue-green colour with Gregersen's test, appearing within thirty seconds, is proof positive of the presence of occult blood in the stools irrespective of the patient's diet.
6. Meat in the diet may occasionally cause a faint colour with Gregersen's test after thirty seconds.
7. Occult blood may occasionally be present in the stools of patients suffering from acute rheumatic fever and chorea.
8. A milk diet is liable to cause confusion by checking bleeding.

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REFERENCES.

- ¹ Coope, R.: *Lancet*, 1920, ii, 291.
- ² Hurst, A. F.: *BRITISH MEDICAL JOURNAL*, 1925, ii.
- ³ Beaumont, G. E., and Dodds, E. C.: *Recent Advances in Medicine*, p. 190.
- ⁴ Maclean, H.: *Digestion and Gastric Disease*, p. 129.
- ⁵ Bennett, T. I.: *The Upper Alimentary Canal in Health and Disease*, 1925, p. 174.
- ⁶ Koopman, J.: *Arch. f. Verdauungskr.*, 1921, 27, 122.
- ⁷ Gregersen, J. P.: *Ibid.*, 25, 3, 1919.
- ⁸ Adler, E.: *Ibid.*, 27, 153, 1921.
- ⁹ Boas, I.: *Ibid.*, 1921, 27, 37.
- ¹⁰ Aaron, C. D.: *Journ. Amer. Med. Assoc.*, lxxxiii, 1924, 741-743.
- ¹¹ Abrahams, A.: *Lancet*, 1920, ii, 420.

BACTERIAL TOXAEMIA AND CARDIAC PAIN.*

BY

WILLIAM GORDON, M.A., M.D.CANTAB.,
F.R.C.P.LOND.,

SENIOR PHYSICIAN TO THE ROYAL DEVON AND EXETER HOSPITAL;
PHYSICIAN TO THE WEST OF ENGLAND EYE INFIRMARY.

THE study of cardiac pain suffers, it seems to me, from its existing nomenclature. Eighteenth century names may still serve in the daily routine of practice; but for the purposes of investigation I think we shall do well to make a fresh start, by calling cardiac pain of all sorts simply "cardiac pain," just as we call all abdominal pain simply "abdominal pain," and recording plainly and

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