THE BACTERIAL FLORA OF GASTRIC LAVAGES FROM PATIENTS UNDERGOING PARTIAL GASTRECTOMY

BY

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Several investigations have been made into the bacterial content of the stomach and small intestine in health and disease.

Cregan and Hayward (1953) investigated the bacterial content of the healthy human small intestine by aspiration through the gut wall, and, on the few occasions when growth was present, found only transient flora, mainly mouth species. Anderson and Langford (1958) confirmed these findings, and found no resident flora in cases of coeliac disease and fibrocystic disease of the pancreas.

Howie, Duncan, and Mackie (1953) cultured stomach washings for Cl. welchii after partial gastrectomy in view of the similarity between the clinical symptoms of post-gastrectomy diarrhoea and of the gastro-enteritis caused by food-poisoning with heat-resistant Cl. welchii, type A (Hobbs, Smith, Oakley, Warrack, and Cruickshank, 1953; Oakley and Warrack, 1953). They found numerous Cl. welchii in stomach washings from 12 of 15 patients examined within a week after partial gastrectomy. In eight of the 15 patients, small amounts of Cl. welchii α toxin were also demonstrated in the same specimens.

Duncan, Goudie, Mackie, and Howie (1954) took specimens of jejunal contents by Miller-Abbott tube from eight patients with anaemia or failure to gain weight after partial gastrectomy. They could find no evidence of bacterial colonization in the jejunum of such patients. They also found heavy growths of Cl. welchii, type A, in the stools of five patients with post-gastrectomy diarrhoea and in a case of acute obstruction of the small intestine. Diarrhoea caused by Cl. welchii as a result of food poisoning (McNicol and McKillop, 1958) does not come within the scope of this paper.

The present experiment was based on a series of 60 partial gastrectomies performed by Mr. T. G. E. Loosemore. Specimens were collected from the indwelling Ryle's tube pre-operatively and for a period of 24 to 30 hours after operation. Of the 60 operations, 51 were performed on waiting-list cases for chronic gastric ulcer and duodenal ulcer; six were emergency operations for perforated ulcers, two were emergency operations for haematemesis and melaena, and one radical partial gastrectomy was performed on a case of suspected gastric ulcer, where a small prepyloric carcinoma was found. All patients were given a prophylactic course of “distavone”* (combined penicillin and dihydrostreptomycin) post-operatively.

Method

Gastric lavage specimens were taken from the 60 cases reviewed at the following times: (a) Pre-operatively, except in certain of the emergency cases; (b) hourly for the first six hours after operation; (c) four-hourly thereafter for a period varying from 18 to 24 hours.

The specimens were cultured on horse blood agar plates, incubated aerobically and anaerobically, MacConkey plates, and 7% salt plates. The specimens were also inoculated into cooked meat media, and subcultured on to Nagler plates after 48 hours' incubation. To facilitate isolation of Cl. welchii, the Nagler plates contained neomycin (Lowbury and Lilly, 1955).

All organisms growing on the plates were identified. The antibiotic sensitivities of all staphylococci isolated were determined, and any penicillin-resistant staphylococci were phage typed. From Case 43 onwards, throat swabs were taken routinely on the third or fourth day after operation.

Results

Twenty-three of the pre-operative aspirations were sterile. All these were from cases of chronic gastric ulcer or duodenal ulcer. In 19 of these cases subsequent aspirations grew Bact. coli. This organism appeared three to four hours after operation. Post-operative aspirations grew mixed throat flora in three of the cases with a sterile pre-operative specimen, and, in the remaining

*Distavone (Distillers Co. Ltd.) is a mixture of procaine penicillin G which is sparingly soluble in water, and potassium penicillin G which dissolves readily. On administration there is an initial "loading" dose plus a prolonged "depot" dose of penicillin. A third constituent, dihydrostreptomycin, is effective against Gram-negative organisms and acts synergistically with the penicillin against the Gram-positive cocci.
case, the aspirations remained sterile postoperatively.

Table I shows the preponderant bacterial growths isolated from the gastric washings during specified periods of time. The figures are expressed as the percentage of the total number of cases which grew a certain organism at a certain time. It will be seen that Bact. coli was by far the most common organism found, with Staph. aureus coming second. There was a relatively high incidence of upper respiratory tract flora, which were presumed to come from swallowed saliva.

Cl. welchii was found in the washings of only five cases. Four cases in the series had post-gastrectomy diarrhoea, but in none of the washings from these cases was Cl. welchii isolated. In two of these cases, the diarrhoea was thought to be a result of vagal crush, and in one it was staphylococcal in origin. No cause could be found for the diarrhoea in the other case.

Two cases developed infected wound sites. From one, Staph. aureus was isolated, and, from the other, a mixed growth of paracolon bacilli and coccobacilli.

Table II gives the results of cultures in the 18 cases in which throat swabs were taken. It will be seen that there is a relatively high incidence of Staph. aureus, and, in five cases out of six, the organism was of phage type 80.

Table III compares the incidence of Staph. aureus in throat swabs and gastric aspirations. In all the cases except one, in which Staph. aureus was isolated from the throat, it was also isolated from the stomach washings. In two cases, the organisms in the stomach and the throat were of the same phage type. One of these cases, in which both the throat swab and gastric aspirations contained Staph. aureus, phage type 80, was of interest because no evidence of gastric ulcer was found at operation but microscopical sections showed many pus cells in the gastric mucosa.

In the third case, the organisms from both sites were different strains. In the fourth case, Staph. aureus, phage type 80, was cultured from the throat swab. The gastric washings from this case contained a penicillin-sensitive Staph. aureus up to 12 hours, but thereafter a penicillin-resistant Staph. aureus, phage type 80, replaced it.

The fifth case is of special interest, and deserves a fuller description:

J.D., a man aged 50, was admitted with a history of indigestion for many years, and distension and vomiting for eight weeks. At operation on January 30, 1958, a small carcinoma was found in the prepyloric region, and a radical partial gastrectomy performed. Post-operative progress was good. A Staph. aureus was found in the post-operative gastric aspirations which was not phage type 80.

On January 21, 1958, another patient, G.E., had been transferred to the same ward for an emergency ileostomy to relieve severe ulcerative colitis. He occupied a bed on the other side of the ward, almost directly opposite to the patient J.D. On January 27 culture of the stool of G.E. yielded a Staph. aureus, phage type 80, which was resistant to erythromycin.

A routine throat swab from J.D. on February 4 yielded a Staph. aureus, phage type 80, which was also resistant to erythromycin. On February 11, J.D. developed a transitory attack of diarrhoea (the only complication in an otherwise uneventful post-operative course), and culture of his stool yielded a heavy growth of Staph. aureus, phage type 80, which was of similar sensitivity pattern to the one in his throat.
Patients were also grouped as to whether they had post-operative fevers or not. A patient assumed to have had a post-operative fever was taken as one developing a temperature of at least 100° F. on at least two occasions. Table IV gives the results of this investigation. It will be seen that the incidence of "distavone"-resistant Staph. aureus in cases with post-operative fever was over four times that in cases without fever.

<table>
<thead>
<tr>
<th>Total cases in series</th>
<th>60</th>
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<tr>
<td>Cases in which Staph. aureus was isolated</td>
<td>26</td>
</tr>
<tr>
<td>Percentage of cases in which Staph. aureus was isolated</td>
<td>43</td>
</tr>
<tr>
<td>Staph. aureus was isolated</td>
<td>20</td>
</tr>
<tr>
<td>Cases with post-operative fever</td>
<td>16</td>
</tr>
<tr>
<td>Percentage of fevers in total number of cases</td>
<td>26-7</td>
</tr>
<tr>
<td>Post-operative fevers in which Staph. aureus was isolated</td>
<td>14</td>
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<tr>
<td>Percentage of post-operative fevers in which Staph. aureus was isolated</td>
<td>87</td>
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<tr>
<td>Percentage of post-operative fevers in which &quot;distavone&quot;-resistant Staph. aureus was isolated</td>
<td>50</td>
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<tr>
<td>Cases without post-operative fever</td>
<td>44</td>
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<tr>
<td>Percentage of cases without post-operative fever in which Staph. aureus was isolated</td>
<td>12</td>
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<tr>
<td>Percentage of cases without post-operative fever in which &quot;distavone&quot;-resistant Staph. aureus was isolated</td>
<td>28</td>
</tr>
<tr>
<td>Percentage of cases without post-operative fever in which &quot;distavone&quot;-resistant Staph. aureus was isolated</td>
<td>11</td>
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From Table IV it may be assumed that the prophylactic use of "distavone" post-operatively is useful therapeutically, since Staph. aureus was isolated from 43% of cases, whereas only 26.7% of cases developed post-operative fevers. The high incidence of "distavone"-resistant Staph. aureus in the cases of post-operative fever suggests that many of these fevers were staphylococcal in origin.

**Conclusion**

The post-operative procedure of aspirating gastric contents for removing blood is fraught with the possible hazard of introducing throat and aerial flora via the Ryle's tube into a bacterial-nutrient medium, but the advantages gained by aspiration outweigh the risk involved. Aspiration removes stale, fermenting blood and so prevents this fetid material passing into the intestines where antibacterial acid is absent. This may account for the incidence of only one case (J.D.) of post-operative staphylococcal enteritis out of 26 patients from whom Staph. aureus was isolated in post-operative gastric secretions.

The patient, J.D., had been exposed to a heavy dissemination of staphylococci from another patient, G.E. Barrier nursing of septic cases, dressings changed in a special nursing room designed to avoid both contact and air-borne infection (Colebrook, 1958), strict adherence to the no-touch technique of dressing, and freshly laundered cotton blankets (Schwabacher, Salsbury, and Fincham, 1958), are some of the essential precautions to prevent staphylococcal enteritis.

**Discussion**

It must be assumed that organisms such as streptococci and neisseriae are present in gastric aspiration specimens as a result of the patient swallowing saliva containing these organisms.

In an attempt to determine the source of other organisms found in the aspiration specimens, phenolphthalein phosphate plates containing penicillin and Nagler plates were exposed in a surgical ward. Very few colonies of Bact. coli and Proteus were found after incubation, and one can only assume that these organisms were present in the aspirations as a result of reflux from the gut.

Large numbers of Staph. aureus were found on the exposed plates, and these obviously make their way to the stomach by inhalation and by swallowing of saliva and upper respiratory tract secretions.

No relationship was found between the presence of Cl. welchii in the aspirations and post-operative diarrhoea. If the Cl. welchii isolated came by reflux from the gut, they were probably not toxigenic strains. It is quite possible that they were inhaled and swallowed organisms, in view of the fact that moderate numbers of colonies were obtained from the exposed Nagler plates.

**Summary**

The bacteriological findings in 60 cases undergoing partial gastrectomy are reviewed.

Twenty-six of the cases were infected with Staph. aureus.

Only one case had staphylococcal diarrhoea. There was no evidence to relate the presence of Cl. welchii in the washings and post-operative diarrhoea.

The value of post-operative gastric aspiration is discussed.

**References**