Granulomatous peritonitis and appendicitis of food starch origin

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Abstract
Two patients with food starch granulomatous reactions, one a necrotising granulomatous peritonitis after the perforation of a gastric ulcer and the other a non-necrotising granulomatous appendicitis, are described. The possibility of food starch induced inflammation must be considered in the differential diagnosis of granulomatous diseases of the gastrointestinal tract.

Starch, the main polysaccharide of plant cells, is usually non-pathogenic to humans. Nevertheless, bronchopneumonia caused by aspiration of non-digested starch granules and postoperative granulomatous inflammation as a result of starch from surgical gloves are well recognised complications. Very occasionally, glove starch can cause an anaphylactoid reaction or contact dermatitis. Granulomatous peritonitis of food starch origin is even more uncommon. To the best of our knowledge, only five cases have been reported. We report a patient with a granulomatous peritonitis and one with granulomatous appendicitis, and discuss the differential diagnosis of granulomatous inflammation secondary to food starch.

Case reports
PATIENT 1
A 49 year old man was admitted to Huddinge Hospital in July 1988 with a two month history of cough, night sweating, loss of weight, and fever up to 39°C. His previous history included a duodenal ulcer verified by x ray in 1974, but he had not had any ulcer symptoms since 1977. An x ray examination on admission showed several large lung infiltrates with cavernous changes. Histology of the bronchial biopsy specimen showed vascular changes with a mixed inflammatory infiltrate also containing atypical reticulum cells, consistent with lymphomatoid granulomatosis. Gastroscopy showed a polyoid tumour and a large mucosal infiltration as well as several small gastric ulcers. Histology and immunohistochemistry of the biopsy specimen of the large mucosal lesion showed infiltration by non-Hodgkin's malignant lymphoma, large cell type of B lymphocyte origin, Ki 1+ Intensive combined chemotherapy resulted in an initial slight improvement but the lung infiltrates progressed despite treatment. The patient's condition deteriorated and he died four months after the onset of the disease.

At necropsy, several large, necrotising tumour like infiltrates were found in the lungs. In the stomach there was a prepyloric ulcer, 2-3 cm in diameter, that penetrated to the inferior surface of the liver and several erosions or shallow ulcers of 3 mm in diameter, but the polypoid mass seen at gastroscopy was not found. In the peritoneum there were numerous grey white nodules (maximum diameter of 4 mm) with or without necrotic centres.

Histological examination of these peritoneal nodules showed epithelioid cell granulomatous inflammation, with multinucleated giant cells of either Langhans' or foreign body type. In the centre of the non-necrotising granuloma there were roundish or oval starch granules, ranging in maximum diameter from 70 μm up to 220 μm. They contained oval microspheres 15–55 μm in maximum diameter and a homogeneous eosinophilic substance between the microspheres (Fig 1). Both the microspheres and the outer shell of the starch granule showed positive birefringence (Fig 1c), but only a few Maltese crosses were seen. Several starch granules showed signs of degradation, these granules were not birefringent. The granules were periodic acid Schiff positive after diastase treatment. Some of the large granulomas contained necrotic material in the centre with partly degraded starch granules and remains of identifiable cellulose plant cell walls (Fig 2). Similar granulomas were observed at the base of the large gastric ulcer and between the ulcer and the liver.

No granulomas or starch granules were seen in the small gastric ulcers. In these sites, as well as within the greater omentum near the stomach, there were infiltrates of non-Hodgkin's malignant lymphoma of the same type as diagnosed in the biopsy specimen. In the lungs, large necrotic areas were surrounded by a mixed cellular infiltrate containing many atypical reticulum cells and a few lymphocytes, plasma cells, and eosinophil leucocytes. Vasculitis with atypical reticulum cells within the media and around the vessels, was also observed.

The final histopathological diagnosis was: lymphomatoid granulomatosis of the lung, non-Hodgkin's malignant lymphoma of the polymorphic centroblastic type in the stomach, and food starch peritonitis after the penetration of a large gastric ulcer into the liver.

PATIENT 2
A 35 year old man with right lower abdominal pain was operated upon at Södertälje Hospital because of suspected acute appendicitis. Histologically, the appendix showed an acute inflammatory exudate within the lumen and ulceration of the mucosa. Clusters of epithelioid cells and Langhans' giant cells formed non-necrotising granulomas within the germinative centre of the enlarged lymph follicles and within the sub-

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Figure 1: Patient 1. (A) Peritoneal granulomas around degraded fragments (arrow); or (B) fairly well preserved starch grains (arrow) (haematoxylin and eosin, bar: 50 µm). (C) Both the outer membrane and the starch granules are birefringent (polarised light, bar: 50 µm).

Figure 2: Patient 1. Islet of Langhan's; remnants of vegetable cells (arrow) and starch grain (arrowhead). (Haematoxylin and eosin, bar: 50 µm).

Figure 3: Patient 2. (A) Epithelioid cell granuloma around degenerated starch grain. Note shadows of starch granules (arrow). (B) A few vegetable cells (arrow) are surrounded by foreign body giant cells. (Haematoxylin and eosin stain, bar: 50 µm.)

Discussion

Most starch in food is degraded and absorbed within the small intestine, but a small amount reaches the large intestine intact (resistant starch), and participates in important fermentative processes. Starch granules within the intestinal lumen are not pathogenic. Nevertheless, free starch granules of corn or rice used as lubricants in surgical gloves can cause a foreign body like or sarcoidosis like granulomatous inflammation.

Figure 3. (A) Epithelioid cell granuloma around degenerated starch grain. Note shadows of starch granules (arrow). (B) A few vegetable cells (arrow) are surrounded by foreign body giant cells. (Haematoxylin and eosin stain, bar: 50 µm.)

Both clinical and experimental data suggest that the inflammation is evoked by delayed type hypersensitivity. Recent in vitro investigation has, however, shown that vulcanisation accelerators used during the final stage of glove manufacture become adsorbed on to starch particles and may be toxic.

Aspiration of food causes a non-specific inflammation in the bronchioli and the surrounding lung tissue predominated by neutrophil leucocytes, which later on can be replaced by a caseating tubercle like inflammatory reaction. Food starch related inflammation in other organs is extremely rare. A few patients with granulomatous peritonitis with remnants of plant cell walls have been described after perforation of a gastric ulcer, the intestine, and an appendix.

Intact starch granules in granulomatous peritonitis have been observed in only two patients, after perforation of colon diverticulitis and of an incarcerated small intestine, respectively. The pathogenesis of food granuloma is obscure. Davies and Ansell suggested that other components of foodstuffs may possibly act as adjuvants in eliciting an immunological reaction.

Our patients represent, to the best of our knowledge, the third case of food starch granulomatous peritonitis and the first case of granulomatous appendicitis elicited by histologically identifiable starch granules. Many of these starch granules showed various degrees of degradation, suggesting that they were probably not of potato origin, as potato starch is very resistant to digestion. Histological comparison with the starches of various seed types suggested that they came from yellow pea, lentil, or bean.

The detailed histological analysis of these two patients showed that the response around complex starch granules is an epithelioid cell granulomatous inflammation suggesting a delayed type hypersensitivity reaction. In the first patient, starch reached the peritoneum through a perforated gastric ulcer. In the second, plant cell components probably reached the lamina propria of the appendix through small erosions that had developed as a complication of acute appendicitis. The development of starch granulomas within the mucosa raises the possibility that starch may play a role in the induction of...
granulomatous inflammations of the intestine.

Food starch granulomatous inflammation of the gastrointestinal tract is probably more common than a survey of the published reports suggests, and many cases almost certainly go unreported or unrecognised. Food starch granulomas can pose a problem to the histopathologist. Degradation of, or scarcity of, starch granules may make the recognition of the true nature of the disease difficult and lead to an erroneous diagnosis of Crohn's disease, sarcoidosis, tuberculosis, or some other granulomatous inflammation. If starch granules are found in the section, glove starch peritonitis and various worms and their ova enter the differential diagnosis, especially if no cellulose plant cell walls can be found or the birefringence has been lost through degradation. In glove starch peritonitis, only starch microspheres can be found, but no intact starch granules composed of several microspheres and an outer shell or the remnants of them. The shape and size of the microspheres can also help in the differential diagnosis. Glove powder is made from Indian corn or rice; their microspheres are almost uniform and spherical, and smaller (5–12 μm in diameter) than those of lentils, beans, or peas. In the differentiation of food starch granulomatous inflammation from worms, the structure of the outer shell of the starch granules, and the presence or absence of muscle cells, sexual organs, and intestine can help.

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