

# Food-starch granulomatous peritonitis

JD DAVIES, ID ANSELL

*From the Departments of Pathology, University of Bristol, Bristol BS8 1TD, and the City Hospital, Nottingham NG5 1PB*

**SUMMARY** Two cases of peritoneal granulomatous reactions to food starch are described. They followed bowel perforation and clinically mimicked tuberculous and glove-powder starch peritonitis. Their histological differences from corn-starch peritonitis warrant attention in the absence of previous documentation of starch as a component of peritoneal food granulomas. Food-starch granules tend to be larger than those of glove powder, are often oval, and may be extremely resistant to salivary diastase digestion.

Starch peritonitis, caused by glove powder, is now a well recognised post-operative complication with a characteristic clinical presentation.<sup>1</sup> It is marked histologically<sup>2</sup> by a granulomatous reaction, which appears to reflect a delayed cell-mediated response in individuals hypersensitive<sup>3</sup> to Indian corn starch. The starch granules are usually readily identified in tissue sections when polarised light, periodic acid-Schiff or iodine stains are employed. We wish to report two cases of a granulomatous peritonitis, of different aetiology, in which starch granules are also identifiable. The condition merits clear distinction from surgically induced starch peritonitis.

## Case reports

### CASE 1

A 76-year-old woman presented in April 1973 with intermittent abdominal pain centred on the umbilicus. This symptom, and recent constipation, had been present for six months. Palpation of her abdomen revealed two ill-defined masses in the vicinity of the sigmoid and transverse colon. Barium enema showed narrowing of the colon in these sites and numerous colonic diverticula. At laparotomy, six months after onset of symptoms, inflammatory masses in the same areas were found, together with omental adhesion to the sigmoid colon. Also present were numerous omental and peritoneal nodules, three of which were biopsied. A presumptive frozen-section and clinical diagnosis of abdominal tuberculosis was made and antituberculous chemotherapy instituted and continued for the early postoperative period. This was subsequently discontinued. No recurrence of symptoms has occurred.

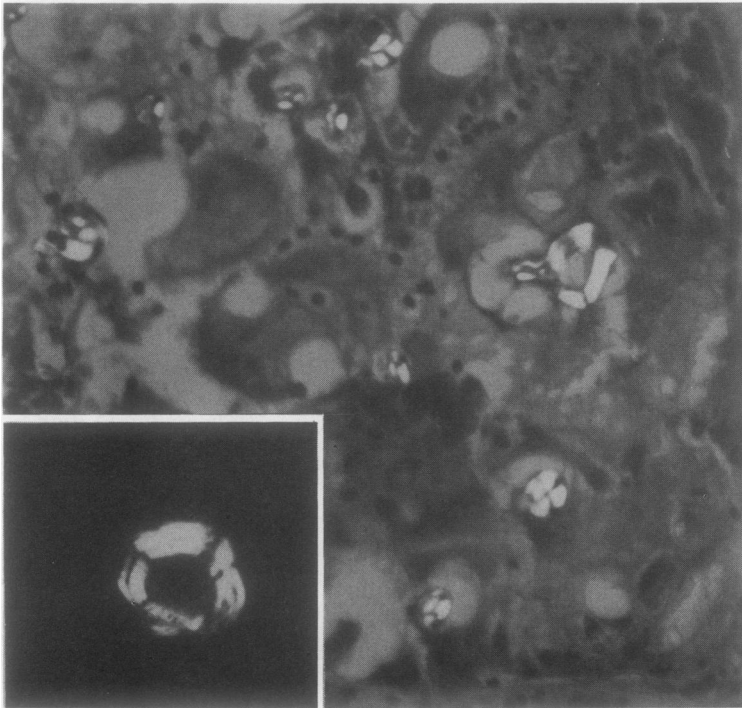
### CASE 2

A 69-year-old man was admitted for urgent repair and exploration of a strangulated left inguinal hernia in June 1982. At laparotomy gangrenous bowel was found incarcerated in the hernial sac and free faecal fluid was noted in the peritoneum. No peritoneal nodules were seen at that time. The hernia was repaired, some seven feet (2.13 m) of small bowel resected, and an ileostomy was formed. Postoperatively, apart from failure to gain weight, recovery was unremarkable. Seven weeks later laparotomy was performed in order to reanastomose the small bowel. The peritoneum was found to be studded with small nodules. A clinical diagnosis of post-operative glove-powder peritonitis was made and one of the nodules excised. The postoperative recovery from the second laparotomy was uncomplicated.

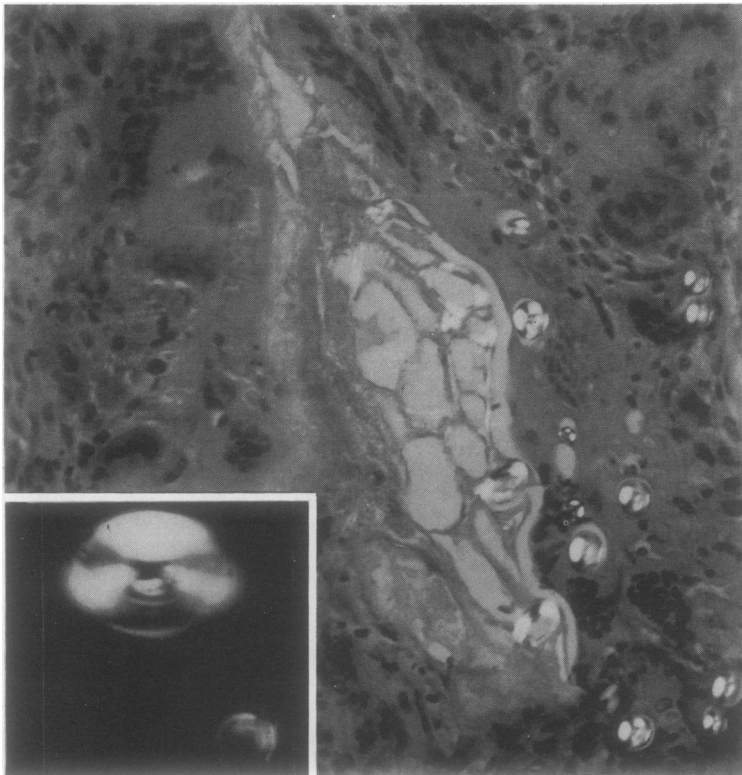
### MICROSCOPIC APPEARANCES OF FOOD-STARCH GRANULOMAS

The peritoneal biopsies from both cases showed giant-cell granulomata (Figs. 1 and 2) which contained numerous foreign-body-type and Langhans giant cells. Also present were mononuclear macrophages, some epithelioid cells, small round cells and a few plasma cells. The older lesion (case 1) contained some foamy macrophages, Touton giant cells and focal fibrosis around areas of fat necrosis. In neither case were eosinophils conspicuous.

A prominent feature in both biopsies was the presence of anisotropic starch granules which exhibited a radial Maltese-cross birefringence. In both cases the starch was variable in shape and size, with near-circular and oval granules ranging in maximum diameter from  $< 5 \mu\text{m}$  up to  $40 \mu\text{m}$  in case 1, and up to  $50 \mu\text{m}$  in case 2. In the younger lesion (case 2)



**Fig. 1** Case 1. Giant cell granulomatous reaction to variable sized round and oval starch granules. Asymmetric Maltese cross birefringence of starch. Insert: Hollow core to partially digested granule. Haematoxylin and eosin in polarised light  $\times 300$  (insert  $\times 670$ ).



**Fig. 2** Case 2. Oval starch granules and cellulose plant cell walls surrounded by giant cells. Insert: Ovoid Maltese cross birefringence with eccentric secondary core. Haematoxylin and eosin in polarised light  $\times 270$  (insert  $\times 670$ ).

almost all granules were intact and most showed an eccentric second bright centre of birefringence between two arms of the Maltese cross (Fig. 2 insert). In case 1 many granules were fragmented, and some exhibited a central non-birefringent core (Fig. 1 insert). The colour of the granules was variable: colourless, pale blue and khaki forms being found. The granules were PAS-positive and stained a purple-red with Gram. There was considerable resistance to salivary amylase: even prolonged digestion for 90 min failed to abolish the PAS-reactivity. Trypsinisation was without effect upon the staining reactions of the starch granules.

Apart from starch granules, in the background there were other anisotropic structures. Some were identifiable as cellulose plant cell walls (Fig. 2) but most were elongated near-rectangular fibres, and in case 1 many unidentified crystals up to 15  $\mu\text{m}$  in length were present. Most fibres and the cellulose walls were PAS-positive and stained purple-red in Gram preparations. The crystals were areactive to Gram staining. The presence and quantity of these anisotropic structures varied with the level of sectioning from the paraffin block. In some blocks from case 1 cellulose walls were completely absent.

## Discussion

Awareness of the combination of starch granules and granulomatous reactions may mislead the diagnostic histopathologist into assuming that all such lesions result from peritoneal contamination by surgical glove powder. Most lubricant glove powders nowadays are made in Europe from Indian corn. Some in the United States are prepared from rice starch.<sup>4</sup> The starch granules from these sources, which are selected for their lubricant properties, are relatively uniform in size, near-spherical, and range in modal diameter from 5–12  $\mu\text{m}$ .<sup>5</sup>

Starch granules from other plants vary considerably in their size, shape, and modal diameters. Indeed their variability is utilised in botanical identification of their source.<sup>6</sup> The storage starch granules from plants used as foodstuffs are similarly varied in size, shape and resistance to digestion by animal amylases.<sup>7</sup> However the basic radial structure of starch granules is shared by all, yielding Maltese cross birefringence in polarised light.<sup>8</sup>

The variable size, oval shape and morphology of the granules seen in our case 2 suggest that the starch was derived from potatoes. The eccentric core, as seen in polarised light, of the granules is unlike the radially symmetrical corn and rice starch granules. Since the starch was only poorly digested by the peritoneal macrophages in the seven weeks after bowel rupture, the basic structure of the starch

was sufficiently well preserved to show distinct differences from glove-powder starch. Such resistance to digestion is characteristic of potato starch.<sup>7,8</sup> The granules in case 1 may have been present in the peritoneal cavity for as long as six months. Their structure reflects more advanced digestion, with some loss of the central birefringence. Scanning electron microscopic studies have shown that after initial erosion of part of the outer shell of any starch granule, hollow cores are often observed with more advanced digestion.<sup>7</sup> For this reason the precise vegetable origin of these granules is less certain.

Food granulomas in the peritoneal cavity have been described on several occasions<sup>9–12</sup> after rupture of stomach, appendix, and bowel. As in our cases cellulose plant-cell walls were present and led to the correct diagnosis. However when such components are less conspicuous, or when crystalline material predominates, as in case 1, the diagnosis may be less obvious. Such potential error may be increased if, as in case 2, the surgeon himself suspects a postoperative glove-powder peritonitis, in which crystalline material may also be present.<sup>2</sup> Conversely, contamination of surgical starch powder by crystalline material or extraneous animal and vegetable matter may produce diagnostic confusion when peritoneal lesions are subsequently examined histologically. To our knowledge no previous report has described the presence of starch granules in peritoneal food granulomas. It is, however, a potentially misleading diagnostic feature of food granulomas, and the resistance to digestion of many storage starch granules suggest that they are less uncommon than previous reports have indicated. It would be unfortunate if food-starch granulomas were confused with glove-powder peritonitis, which appears in man<sup>3</sup> and guinea pigs<sup>13</sup> to be evoked by cell-mediated hypersensitivity to Indian corn starch. The pathogenic mechanism of food granulomatous reactions is currently unknown. Possibly the other components of food granulomas, like talc crystals in glove powder,<sup>14</sup> may act as adjuvants in provoking an immunological response to the food starch.

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Requests for reprints to: Dr JD Davies, Department of Pathology, University of Bristol, University Walk, Bristol BS8 1TD, England.