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SHORT COMMUNICATION

Ulcerative colitis in the guinea-pig caused by seaweed extract

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Carrageenans are widely used as food ingredients as well as medicinally in various parts of the world (Bonfils, 1968). As yet there have been no reports of adverse effects following the use of these substances (Anderson, 1967).

Recently, we have found a high incidence of ulcerative colitis in several species of laboratory animals fed extracts of various red seaweeds (Marcus & Watt, 1969).

In this paper we present our findings on degraded and undegraded carrageenans derived from *Eucheuma spinosum* and fed to guinea-pigs over a relatively short time.

Method

Adult male albino guinea-pigs, of 500 g average body weight, bred in our own laboratory, were housed in separate cages and fed a normal cube diet (S.G.1) supplemented daily with fresh cabbage.

One group of 10 animals received as drinking fluid a 1% aqueous solution of undegraded carrageenan[1] derived from *E. spinosum*. A second group of 10 animals received as drinking fluid a 5% aqueous solution of degraded carrageenan[2] also derived from *E. spinosum*. The degraded product, being less viscous, was used at a higher concentration than the undegraded product. Solutions of carrageenan were freshly prepared each day, stored at 4° and supplied in drinking bottles that were cleaned daily; no gross bacterial contamination was observed. Allowing for spillage from the drinking bottles, the daily intake per animal of undegraded carrageenan was not more than 1·5 g/kg and of degraded carrageenan not more than 2 g/kg body weight. A third control group of 10 guinea-pigs received water *ad lib* but without added carrageenan.

At frequent intervals throughout the experiment, the stools were examined for occult blood using the Hematest method. The animals were killed, using ether anaesthesia, between 20 and 30 days after the start of the experiment. The gastrointestinal tract was entirely removed. The large bowel was emptied of faeces, distended with 10% formol saline, and after fixation, carefully examined. Histological sections were prepared from various parts of the colon and stained with haematoxylin and eosin, and also with toluidine blue.

Results

In the first group which received undegraded carrageenan, four guinea-pigs were killed after 20 days and two of these showed multiple ulcerative lesions in the caecum. The remaining six animals were killed after 30 days; traces of occult blood in the faeces were present from day 23. These animals had ulcerative lesions in the caecum

[1] Undergraded carrageenan was obtained from J. W. Cumming & Son Ltd, Salford.

[2] Degraded carrageenan was kindly supplied by Laboratories Glaxo-Evans, Paris.

and two had lesions extending into the colon for a short distance. The overall incidence of ulceration in this group was 80%.

In the second group, which received degraded carrageenan, most of the animals showed looseness of the stools by the end of 10 days; from the 20th to the 30th days, all had occult blood in the faeces. In this group the incidence of ulcerative colitis was 100%. In five animals killed between the 20th and 25th days, the lesions were mainly in the caecum; in the remainder, killed between the 26th and 30th days, ulceration had extended into the lower colon and rectum.

In both experimental groups the lesions were multiple, numbering sometimes in the hundreds. Macroscopically, they consisted of pin-head sized ulcers, rounded or slightly irregular in outline. Some had coalesced to form larger lesions, often linear in shape. Histologically, the ulcerations involved mainly the mucosa and showed features of both acute and subacute inflammatory infiltration, as well as crypt abscesses (Fig. 1). Macrophages containing metachromatic material were frequently seen in toluidine blue stained sections.

In the control group, the animals remained healthy throughout the 30 days. There was no occult blood in the stools and no pathology in the caecum, colon or rectum.

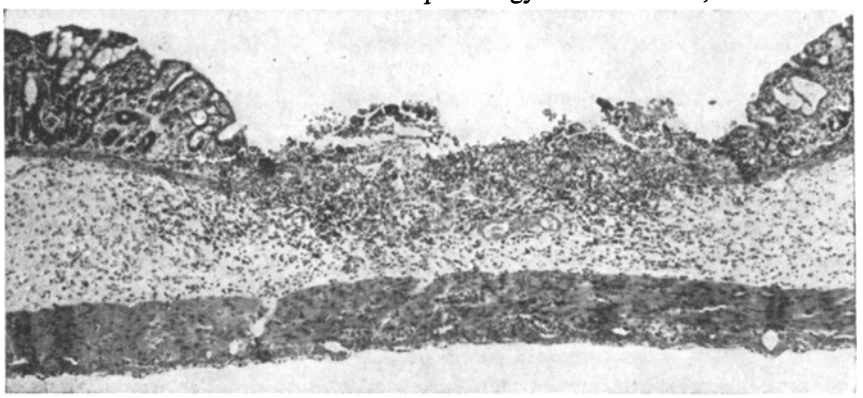

FIG. 1. Subacute ulcer in colon of a guinea-pig fed carrageenan: heavy cellular infiltrate in ulcer base and in submucosa. H. & E. × 56.

Discussion

Our results have revealed a hitherto undescribed effect of carrageenan, namely ulceration of the caecum and colon in the guinea-pig. The lesions produced are not readily visible unless the bowel is emptied of faeces and examined using transmitted light. This is perhaps why such lesions have not previously been observed.

The more severe ulceration in the animals on degraded carrageenan is more likely to be due to the greater total amount of carrageenan consumed by these animals than to possible contaminants arising as a result of the degradation process.

The ulcerative lesions in the guinea-pig are not identical in distribution with those typically seen in ulcerative colitis in man. Nevertheless, their histological appearance and their confinement largely to the mucosa are features common to both. The significance of our results in relation to human ulcerative colitis is at present only speculative and must await more comprehensive investigation.

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