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Commentary

Ingestion of Asbestos

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Several papers at this conference have dealt with studies of ingestion of asbestos in one form or the other. In one experiment, following asbestos ingestion, a gastric ulcer with an asbestos fiber perforating it was observed. One investigator did not find any significant pathology in the gastrointestinal tract with ingestion of asbestos, and some other workers found few particles here and there.

I suggest that one of our most urgent needs is a proper and suitable choice of an experimental animal. In my opinion, the rat is one of the animals that should not be used. The simple reason is that half of the rat's stomach is lined by squamous epithelium and therefore does not simulate the human stomach. Dr. Shay from the United States (1) has been using rats to produce gastric ulcers which are not at all similar to those found in humans. The ulcers developed in rumenal mucosa which is lined by squamous epithelium. A second difficulty is collection of gastric juice. I do not know of much work that has been done with small intestine—or for that matter, with cecum and colon. I think that the monkey is a difficult animal to deal with. The fact that it is vegetarian also presents difficulties. You always find some food particles in the stomach—there is always some roughage left over. Therefore, if we have to do work on stomach or for that matter on intestine, we should not use monkeys. Now let us take the rabbit. Twenty years ago, I did some experiments on rabbits. I kept them without food for 4 days, put them on water and after 3 or 4 days at sacrifice, stomach food was still present. On gastric analysis we found duodenal ulcer type of high free acidity.

If I am going to work on the ingestion of asbestos particles, I am really tempted to work on dogs. The stomach of a dog is very similar to that of man as far as experimental ulceration is concerned. I produced ulcers in dogs about ten years ago by feeding cinchophen. The ulcers produced were duodenal as well as gastric which resembled histologically that found in humans. With such a big stomach, gastric analysis and work on duodenal intubation as well as histopathological studies can be done. The other animal which I would choose for this type of work is the guinea pig, which is inexpensive and easy to handle.

One of the important things we should study in relation to asbestos fiber is the mucous factor. One of the reasons, if I may be permitted to suggest, why the monkeys described by Webster *(2)* did not get particles attached to the stomach mucosa may be because of large amounts of roughage in the food. The roughage causes a mucous secretory response by mucous cells, and the asbestos particles adhere to the mucus and pass down to the lower intestine, thus having no chance to stick to the stomach wall. The mucous barrier may be one of the most important factors that may stop penetration of the particles. Therefore, I think that we should study the movement of the fibers in the gastro intestinal tract in relation to the mucous barrier.

The mucous barrier is not very difficult to study. We can stain the stomach with PAS and study mucus of the mucous cells present in the

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mucosa; then we can estimate mucus in the gastric juice in terms of glucuronic acid. That is simple. If the mucous barrier of the stomach is broken by some method and asbestos particles are fed to the animal, then, I would hope there may be some type of response. The mucous barrier of the stomach can be broken by drugs like cinchophen or phenylbutazone.

The mucous barrier may be different in different animals. I am told that the mucous barrier is related to certain blood groups. Persons who have a deficient mucous barrier are more prone to peptic ulcers. In some people when there is a breakdown of the mucous barrier, then they may be more prone to gastric ulcers. People who have a deficient mucous barrier and ingest asbestos particles may develop tumors of the intestine or stomach.

It is interesting to switch over from lung pathology to that of the gastrointestinal tract. I took a journey of over 9,000 miles to participate in these deliberations. I am very grateful to the convenors of the conference for according me this privilege.

REFERENCES

1. Shay, H., et al. A simple method for the uniform production of gastric ulceration in rat. Gastroenterology, **5**: 43 (1945).
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