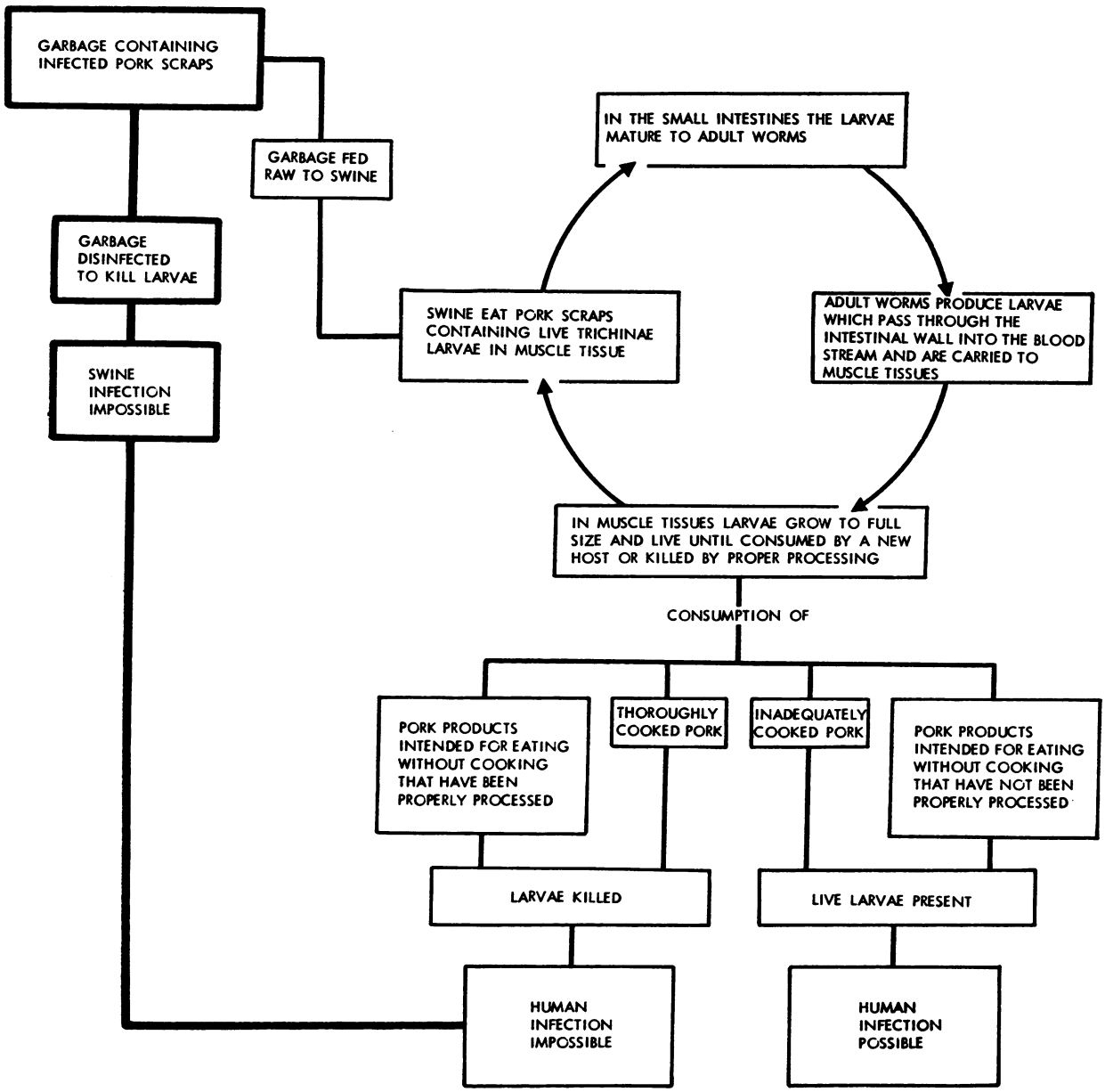
Trichinosis



Human Trichinosis: Transmission and Control

Prevalence • Transmission • Prevention

Highlights from the First National Conference on Trichinosis, 1952

The problem of trichinosis in the United States was reexamined at the First National Conference on Trichinosis, held at the American Medical Association's headquarters in Chicago on December 15, 1952. Sponsoring the conference were the American Board of Veterinary Public Health, the American Medical Association, the American Society of Clinical Pathologists, the American Veterinary Medical Association, the Association of State and Territorial Health Officers, the Conference of Public Health Veterinarians, the Michigan-Memorial Phoenix Project of the University of Michigan, and the Public Health Service.

Topics considered by the conference included the prevalence of trichinosis in man and in swine, principal clinical features of the disease in man, relation of garbage to swine diseases, regulation of garbage-feeding practices, the Federal meat inspection program, the effects of rapid-freezing temperatures and of ionizing radiation on trichinae in pork, and State problems in the control of garbage-borne swine diseases.

The précis appearing here of eight of the conference discussions were prepared by the discussants. The essential points of a ninth, by Ralph J. Van Derwerker of the Public Health Service, are included in the paper presented on page 421. Duplicated copies of the complete papers and of the recommendations adopted by the conference may be obtained from the Secretary of the First National Trichinosis Conference, c/o Veterinary Public Health Section, Epidemiology Branch, Communicable Disease Center, Public Health Service, Atlanta 5, Ga.

A Health and Economic Problem

Trichinosis is a disease of animals, particularly of swine, which affects man when raw or improperly cooked pork containing viable trichinae is eaten. Trichinosis has been shown to have an almost worldwide distribution. It is most prevalent in countries where pork is often consumed raw and least prevalent in Jewish and Mohammedan areas.

Hall and his associates have published a series of papers concerning examination for trichinae of human diaphragms obtained at autopsy. Of 5,313 diaphragms, 855 showed evidence of trichinae. It is estimated that 1 out of 6 persons in the United States, or about 25,000,000, alive today probably harbor trichinae. To reach this total, there would have to be 350,000 new infections each year. If the conservative figure of 51 larvae or more per gram of diaphragm muscle is used as an arbitrary threshold for producing symptoms, 4.5 percent of

all persons infected, or about 16,000, should exhibit clinical symptoms. This estimate far exceeds the annual average of 336 cases (1942 through 1951) reported in this country. The difference is probably due to inadequate reporting, mildness of symptoms, and the difficulties of making a clinical diagnosis.

It is estimated that of the 60,000,000 hogs slaughtered yearly, 1.5 percent, or 950,000, are infected with trichinae. Although only 40 percent of the trichinosis in hogs can be blamed on those hogs fed entirely on raw garbage, a majority of the remaining 60 percent must be attributed to those fed partly on raw garbage.

Trichinosis is a national problem not only of public health concern, but of economic importance to producers of pork.

—VERNON B. LINK, M.D., *deputy officer in charge of the Communicable Disease Center, Public Health Service*

Garbage-Borne Swine Diseases

Garbage serves as an excellent vehicle for transmission of viral, bacterial, and parasitic diseases in swine. Hog cholera, vesicular exanthema, foot-and-mouth disease, salmonellosis, tuberculosis, brucellosis, and trichinosis are all transmitted in garbage. Hog cholera is the most important porcine disease in the United States, but fortunately this disease is not transmitted to other animals or to man. Vesicular exanthema produces heavy losses among hogs, the only animals that are naturally susceptible to this disease. Foot-and-mouth disease affects not only hogs, but also other cloven-footed animals. Trichinosis affects swine and at least 25 other species of animals. Its chief economic importance lies in the danger of its transmission to man.

All four of these important diseases of swine are associated with the feeding of raw garbage. Their control, therefore, depends upon elimination of this practice. Uniform State and Federal regulations are needed for control of garbage feeding.

Canada and Great Britain have had success in controlling these diseases by requiring that garbage which is fed to swine must be cooked. Atlanta, Ga., has found incineration to be the most efficient and economical method of disposing of garbage.

—JAMES H. STEELE, D.V.M., M.P.H., *chief of the veterinary public health section, epidemiology branch, Communicable Disease Center, Public Health Service.*

Trichinae in Swine

Of the many mammalian hosts of *Trichinella spiralis*, only the domestic hog is of importance from the standpoint of human health. There is reason to believe, however, that domestic swine in the United States were once infected with trichinae to a much greater extent and to a significantly greater degree than at present.

In the 1930's nearly 1 percent of farm-raised hogs and about 10 percent of garbage-fed hogs in the Atlantic seaboard States harbored trichinae. At least two-thirds of the infected farm-raised hogs contained the parasites in numbers so small that they would undoubtedly have escaped detection by routine microscopic inspection, whereas only about one-third of the infected garbage-fed hogs contained parasites in such small numbers.

In a recent study of more than 3,000 hogs originating in several corn-belt States, trichinae were found in only 0.6 percent when the examinations were made by digesting the pillars of the diaphragm in acidified pepsin. Trichinae were not found in any of these infected diaphragms when they were examined routinely in press preparations, showing that the infections were very light. In parallel studies of a series of about 1,500 samples from garbage-fed hogs on the eastern seaboard, trichinae were found in 11.5 percent when the samples were examined by the digestion method and in nearly 5 percent when examined routinely in press preparations. These data reemphasize the role of garbage feed in the transmission of trichinae to hogs and to human beings who eat the infected meat raw, inadequately cooked, or imperfectly cured.

—BENJAMIN SCHWARTZ, M.D., *chief of the zoology division, Bureau of Animal Industry, U. S. Department of Agriculture*

Prevalence and Prevention

In autopsy surveys of over 10,000 persons in the United States, the average incidence of recovery of trichinae larvae was 16 percent. However, it has been demonstrated that with more thorough methods of examination the incidence of recovery is about 30 percent. Available data indicate that the incidence of trichinosis in both man and swine in the United States is the highest of any country in the world. The vast majority of human infections are mild and subclinical; most infections that are severe enough to reach the clinical level are not diagnosed; and among those that are clinically diagnosed, the mortality rate is about 5 percent.

Besides thorough cooking, the methods of prevention include curing and low-temperature treatment of pork as prescribed by Federal regulations. Other control measures adopted by some countries include microscopic inspection of muscle from every hog that is slaughtered, prevention of feeding of garbage to hogs, or cooking of raw garbage if it is to be fed to hogs. Promising new methods of rendering pork free from the danger of trichinosis include extension of techniques for low-temperature treatment and exposure of all raw pork to ionizing radiation. These new methods should be subjected to further intensive research. High hope is held that in the near future all raw pork may be so processed as to reduce the danger of trichinosis to man to a point of practical insignificance in this country.

—S. E. Gould, M.D., *pathologist, Wayne County General Hospital, and clinical professor of pathology, Wayne University College of Medicine*

Federal Meat Inspection

The method of control of trichinosis currently employed by the Federal meat inspection service of the U. S. Department of Agriculture contemplates special treatment under inspection supervision of all pork products customarily eaten without cooking. The so-called microscopic examination was used between 1890 and 1906, but only on export pork. Since 1906 no microscopic examinations have been made of any pork coming under the Federal meat-inspection program.

Under the Federal program, almost all processed pork products are classed as pork products customarily eaten without cooking. The exceptions include bacon, fresh pork sausage and similar breakfast sausage, and hams and pork shoulder cuts that have been cured but not smoked or otherwise processed. Fresh pork cuts, such as chops and roasts, are not classed as pork products customarily eaten without cooking.

Thoroughly tested heating, refrigerating, or curing processes are prescribed and used in federally inspected meat-packing plants for treating the specified pork products. An extensive survey made recently found that the products so treated were safe without exception. Only dead trichinae were found, and these only in a comparatively small number of cases.

—A. R. Miller, D.V.M., *chief of the Federal meat inspection service, Bureau of Animal Industry, U. S. Department of Agriculture*

Low-Temperature Treatment

Although data on the effects of rapid-freezing temperatures on trichinae are thus far limited, recent studies indicate that pork may be made safe against trichinosis by (1) rapidly lowering its temperature to −35° C. or (2) by an initial rapid lowering of its temperature to −18° C. and subsequent storage for 3 days at this temperature. Thus, only a few hours may be required to make pork safe by a rapid-freezing method instead of up to 20 days as prescribed under present Federal regulations.

The practicability and the desirability of adopting a rapid-freezing method to make all pork, both that intended for interstate shipment and that for local sale, free from infective trichinae are considered.

—Donald L. Augustine, Ph.D., *professor of tropical public health, Harvard University*

Effect of Ionizing Radiation

Ionizing radiations, such as X-rays, gamma rays, and high energy electrons, have been

shown to be effective in killing or interfering with normal development of living material. During the past year the effect of radiation on the life cycle of the causative agent of trichinosis (*Trichinella spiralis*) has been studied.

It has been found that about 1,000,000 roentgens of 200 kv. X-rays are necessary to kill all trichina larvae irradiated in vitro. The killing dose of cobalt-60 gamma rays (1.17 and 1.31 Mev.) was found to be about the same.

However, the life cycle of trichina requires that the ingested larvae grow to maturity in the host and then reproduce. It has been found that radiation doses much smaller than killing doses are sufficient to inhibit maturation and that still smaller doses will sterilize the female trichinae and prevent reproduction. With cobalt-60 gamma rays, about 10,000 roentgens will sterilize all the female larvae in rat muscle, as shown by microscopic examination of the adult female forms recovered from the intestinal tract at 6 days and larval forms recovered from the muscle of the test animals at 30 days. Somewhat lower than killing levels of 200 kv. X-rays are equally effective.

Because of the great penetrating power of cobalt-60 radiation, it is believed that large sections of meat such as hog carcasses could, under suitable conditions, be irradiated as a whole, thus providing a direct method of breaking the trichina cycle.

—Henry J. Gomberg, Ph.D., *assistant director, Michigan-Memorial Phoenix Project, and research associate, Atomic Energy Commission Laboratory, University of Michigan; and* S. E. Gould, M.D., *pathologist, Wayne County General Hospital, and research associate, Atomic Energy Commission Laboratory*

State Problems in Control

The continued practice of feeding raw garbage to only a small portion of the swine marketed in the United States is jeopardizing the entire livestock industry of the country. This practice spreads trichinosis, cholera, vesicular exanthema, and even foot-and-mouth disease.

Practices of hog raising vary in different sections of the United States, and the problems of garbage-borne diseases vary with different States and sections of the country. The two main points to consider in controls affecting garbage-borne diseases of hogs are these: (1) Is the State an exporter or importer of hogs and pork? (2) Is the State an exporter or importer of garbage?

Present interstate and State regulations designed to prevent garbage-borne diseases of hogs are ineffectual. Regulations addressed solely to the movement of raw garbage interstate are not sufficient to handle the problems of the States in controlling garbage-borne diseases of swine. Controls must consider garbage, hogs, and pork. The following regulations are recommended: (1) Prevent the interstate movement of raw garbage except under certain specified conditions; (2) prohibit movement of live hogs and pork out of any State which shall fail to have and enforce regulations requiring the cooking of garbage that is fed to hogs.

The success of any individual State's efforts to control these animal diseases rests squarely on the effectiveness of interstate controls.

—Oscar Sussman, D.V.M., *chief of the bureau of veterinary public health, division of environmental sanitation, New Jersey State Department of Health*