constantly attended there to audit his accounts. Something had to be done about it, and the terms of the special committee were those of inquiry in the first instance. Ten questions were sent out to the whole profession, questions which admitted of an answer more than a simple "yes" or "no." In comparison with the charge of apathy which seems to afflict us in this modern age, it would appear that, even then, 2,000 such inquiries drew only 250 replies.

Medical News Items in 1853

Those were the chief problems and controversies of the times, which I have purposely not followed historically to their solution. Many of them, indeed, are much too protracted and involved to be dealt with in the time at my disposal, but it may be of interest to mention a few of the subjects treated in the articles and correspondence at the time and debated at meetings. In 1853 there was a report of a court-martial on a medical officer acquitted of the charge of "conduct disgraceful to the character of an officer and a gentleman," in having subjected himself to the indignity of being publicly kicked; all he appeared to have done was to decline to fight a duel.

On April 7, 1853, Dr. John Snow administered chloroform to Queen Victoria in labour, and this event gave rise to much discussion and many letters in the pages of the *Journal*.

On June 7, 1853, the Irish Medical Association was formed at Dublin upon the model of our own Association. Interesting articles of the time appear on medical ethics, arrears in subscriptions, lunacy acts, advertising, apathy, cholera, and a suggestion for "the establishment in London and other medical schools of a Medical Students' Association."

The year 1853 also saw the foundation of the Medical Benevolent College at Epsom. There are articles illustrating the poor conditions and salaries of medical men doing Poor Law work and of medical officers in the Army and Navy, also on sanitary legislation and preventive medicine.

Conclusion

This review of our founders and their problems has been necessarily sketchy. You may have been impressed, as I have, with the versatility of many in that generation. Certainly their accomplishment in languages and in the literary field reached a perfection which most of us must envy. Compared with them, our present set-up and our outlook is rigid. They seem to have been at all times flexible, not only in thought but in method and in action. We must marvel for instance at the facility with which some of them changed the location of their practices and appeared to take up new roots with great success and with no inhibition as to the future. Above all, certainly on the great question of medical reform and everything that went with it—the increased stature of the doctor, protection of the public, and so on—these pioneers played their necessarily formidable part, as did the parent association. On the question of medical reform they were nearly 40 years ahead of contemporary thought, for the Act of 1858 only granted half of what was in the profession's mind 20 years before, and which did not become law until 1886, and it is probably no exaggeration to say that they blazed a trail through a forest of contention and prejudice, even of the medical corporations at the time, one of which was even accused of selling midwifery licences, and encouraging the creation of a vast number of Members and Fellows for pecuniary gain.

On medical reform the ideal and the approach of our medical forebears transcended the narrow and self-centred outlook of the licensing bodies, and indeed of some Universities. As an Association it should give us heart to recall their courage and their altruism, so that, when necessary, we can remind modern public bodies, whether educational or administrative, of the greatness of our heritage.

AN OUTBREAK OF TRICHINOSIS IN LIVERPOOL IN 1953

BY

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[WITH SPECIAL PLATE]

An outbreak of trichinosis occurred in the Liverpool area in late October and early November, 1953. In the past, localized epidemics of this disease have occurred in various parts of the country, and these have been reviewed by Young (1947). Sheldon (1941) and Jolly (1941) reported the epidemiological features of an outbreak in Wolverhampton, and Evans and Lennox (1953) a somewhat similar occurrence in the Borough of Barry. The main reason for giving an account of this outbreak is that it presented an admirable opportunity of studying the epidemiology and clinical features of trichinosis. The parasitological and pathological findings will be reported in greater detail in the *Annals of Tropical Medicine and Parasitology*.

The first of the 82 cases traced came to our notice when Dr. Robert Kemp telephoned on Friday, November 6, to say that he had just seen a case on a domiciliary visit which he suspected was trichinosis. This patient was admitted to hospital and the diagnosis was later confirmed by muscle biopsy. However, as the clinical findings were so suggestive of trichinosis, inquiries were made immediately in the same and other hospitals, and three further suspicious cases came to light.

It was felt that these cases might be part of a more widespread outbreak, so a letter was sent from the medical officer of health to all general practitioners and consultants describing features of the cases already seen and requesting that he be informed of any further suspected cases. There was a prompt and most helpful response, and cases continued to be reported until the third week in November. All patients were visited by a doctor from the Health Department, and the clinical data presented below were collected in this way. Epidemiological investigations were carried out by two sanitary inspectors, and health visitors undertook the follow-up visits on all the cases.

Epidemiology

The first case occurred on October 25 and the last one on November 18, and the dates of onset of the cases are shown in Fig. A. Those cases in which the diagnosis was confirmed by muscle biopsy are specially

marked; it will be seen that they include the first and last cases. The outbreak rapidly rose to a peak during the first week of November, but died away more slowly, 24 days separating the date of onset of symptoms in the first and last cases.

FIG. A.—Date of onset of the cases.

Patients were traced from all parts of the city and surrounding districts on the north bank of the River Mersey, but the majority lived in the northern part of this area. There was no evidence that different dates of onset were related to the area in which the patient lived.

Source of Infection

(1) *Sausages.* The earliest inquiry suggested that sausages of a certain local firm were most likely to be the cause of infection as the early cases gave a history of eating these sausages, and many of the patients had eaten them raw. Further confirmation came when one of the patients was found to be working in the sausage factory concerned, and reported that she habitually nibbled at raw sausage-meat whilst at work. The diagnosis in her case was established by muscle biopsy. Later, another worker in this factory was found to have developed trichinosis at the same time, and he also gave a history of tasting raw sausage meat whilst at work. As more and more patients were questioned, the connexion between this firm's sausages and infection became more firmly established, as 12 of the patients were employees of the firm—seven butchers, three grocery personnel, and two workers in the sausage factory. Of 82 cases (Table I) 67 gave a history of eating these sausages (34

TABLE I.—Eating Habits in 82 Cases of Trichinosis

	No. of Cases
Infected sausage eaten (raw in 34 cases; cooked in 33 cases)	67
Persons handling infected sausage but not eating any, or any pork product except bacon	5
Persons who ate cooked sliced ham from firm handling infected sausage meat	5
Persons eating pork from different sources (no sausage and no product at all from firm handling infected sausages)	2
Story unreliable through lack of data	3

raw and 33 cooked). In 10 further cases there was a less definite connexion, as these persons had either handled infected sausage or eaten cold sliced ham bought from a shop known to have dealt with infected sausages. It was impossible to obtain accurate information in three of the cases.

(2) *Pork.* There were two persons, however, both reliable witnesses, who were emphatic that they had not handled or eaten any material from the firm involved, and the diagnosis in both cases was undoubted, on clinical grounds, though it was not possible to carry out muscle biopsy. These two cases suggest that at least two or more infected carcasses must have been involved. One of these patients was a widow of 63 living with her two daughters; she bought a joint of pork on October 31 from her butcher, cooked and ate it hot with her daughters on Sunday, November 1. The pork was then placed in the meat safe and she finished off the joint cold on Wednesday, November 4; in doing so, she ate the meat close to the bone.

She then gave her dog the bone; this animal was violently sick the following day. The patient developed a typical clinical attack, with swollen eyes, headache on the 12th, and was found to have an eosinophilia. In addition, the dog developed swollen eyes and conjunctivitis on the 14th. A biopsy on the dog was refused, but there seems little doubt that this animal had also developed trichinosis. The other patient in whom no connexion was traced also gave a history of eating pork at the same time as the case just described, and it was found that both butchers, who were widely separated in the city, received one half-carass of pork from the abattoir on October 24. No record mark is kept of the individual animal carcass delivered, and it has been impossible to trace whether both came from the same pig. There is a need for some form of record which would permit the tracing of such a finding to a particular animal and piggery. In both cases epidemiological investigation pin-pointed the particular carcass involved, but it was impossible to follow up our findings any further.

The investigation was then concentrated to see whether there was any possible connexion between the infected pigs delivered to the sausage factory and those delivered to the two butchers on October 24, as it was felt that the obvious disadvantage of suggesting two different infected sources would be greatly minimized if it could be shown that the pigs came from the same piggery. Once again the lack of adequate marking of individual pig carcasses made it impossible to check on this point. It is, however, of interest that the abattoir supplied both sausage factory and butchers, and that at that time a large consignment of pigs which was going to a bacon factory was diverted for ration meat but was found to be too fatty and, in consequence, most was used for sausage-making. It is, however, possible that one or two carcasses went to butchers for rations and that these, together with the carcasses which went to the sausage factory involved, came from the same infected source.

Methods of Infection

Anderson and Arnstein (1953) state that heating to a temperature of 58° C. for a few minutes kills the *Trichinella* larvae in pork, and that freezing to a temperature of —18° C. for at least 24 hours is required to kill them.

It is easy to understand how infection occurred in the 34 patients eating raw sausage. In a further 33 cases there was a history of eating cooked sausage (Table I), although this group also contained many who handled raw sausages and cooked them. Many of these persons were emphatic that their sausages were not grossly undercooked, and this suggests that what is regarded as ordinary cooking may not destroy all larvae. This is not surprising when it is recalled that the centre of a sausage is often relatively undercooked. The two cases traced to pork roasted at home also suggest that larvae deep in the joint may not be destroyed, and that thorough cooking may be required to render pork completely safe.

The experience of the five persons giving a definite story of handling but not eating any infected sausage, or any other product connected with the outbreak, is most interesting. Infection in these cases probably resulted from either infected sausage-meat on the hands being conveyed accidentally to the mouth indirectly, or by a knife used first to cut sausages and later to prepare a cold dish without adequate cleansing. The former probably occurred in the butchers infected and the latter in the kitchen when the housewives became infected. In all these cases the individual readily agreed that one of either suggestions could have occurred. Infected knives also probably resulted in the five cases traced to cold cooked sliced ham bought from a shop also selling infected sausages.

Characteristics of the Outbreak

Age and Sex Incidence.—Out of 82 cases, 20 were males and 62 females. The full age and sex incidence is given in Table II. The higher incidence in the females than the males is made the more impressive when it is realized that

TABLE II.—*Age and Sex Incidence*

Ages	Men	Women
0-14 years ..	1	4
15-24 " ..	0	5
25-34 " ..	8 (2 butchers+1 sausage worker)	12 (1 sausage worker)
35-44 " ..	4 (2 butchers+1 grocer)	20 (1 grocer)
45 years and over	7 (3 butchers+1 grocer)	21
Total ..	20	62

10 of the men were employees of the firm involved (butchers, grocery assistants, or worker in the sausage factory), but only two of the women worked for the sausage company implicated. Forty-one of the cases occurred in women over 34, and of the 21 cases in women over 44, 11 were habitual raw-sausage eaters or nibblers. That these women, most of whom have eaten raw sausages for years, should develop trichinosis so late in life suggests that either overt infection is uncommon in Liverpool or that the immunity from any previous infections is inadequate to suppress completely the clinical symptoms on further exposure.

Occupation.—It was noted time and again that the only person affected in the household was the housewife who did the cooking. Further evidence that those handling raw food were in a more vulnerable position came from the finding that 10 male workers in the firm were clinically affected. In most instances the association could be easily explained by the eating or tasting habits of the individual involved. Occasionally there was an emphatic denial of these habits, and the inadvertent finger in mouth or infected knives probably explained these.

Incidence of Raw-Sausage Tasters in General Population (Adult Females)

Sheldon (1941) showed that the eating of raw sausage-meat was a fairly common habit in Wolverhampton. During the present outbreak health visitors, on every routine visit made in the course of their work, were asked to inquire into the habits of the housewife in the family. The following results were obtained:

Housewives interviewed ..	3,412
No. of housewives eating or tasting raw sausage ..	497
No. of housewives not eating or tasting raw sausage ..	2,595
No reply ..	320

From the 3,092 replies received 497 (16.1%) of the housewives were found to be habitual raw-sausage eaters or tasters.

Incubation Period

In only very few cases was it possible to obtain accurate information on the incubation period. This was mainly because most persons usually ate the same kind of meals from week to week, obtaining their supplies from the same source. In two cases there were two phases of the illness. The first case was that of a man who developed an acute attack of diarrhoea and vomiting on October 25. He was very ill, had blood in his stools, from which, however, no pathogenic organisms were isolated, and was admitted to the isolation hospital. He was discharged from hospital on November 4, but developed sudden swelling of the eyes, headache, and pyrexia on November 7, and was readmitted. Larvae were found in a muscle biopsy on November 21. If it is assumed that the acute gastro-enteritis symptoms developed within one to two days of eating the infected meal, this gives an incubation period measured to the initial general symptoms of 14-15 days. This patient's wife was also affected, but her first symptoms were general, developing on November 8. The second case had an interval of 13 days between diarrhoea and eye-swelling. In three other patients there were intervals of 10, 12, and 15 days between the last meal of sausages or pork products and symptoms.

Symptomatology

In former outbreaks of trichinosis in this country the symptomatology has been described mainly of the more serious cases which had been admitted to hospital. An attempt has been made in this outbreak to obtain full clinical details from all types of patients affected, including many of the milder cases treated at home; 22 were admitted to hospital and 60 remained at home. Most of the patients seen were treated by their general practitioner, but a few, who had not attended a doctor for their symptoms, were discovered by health visitors; these persons were advised to consult their general practitioners.

It is of importance in such an investigation to ensure that no case was included which was not suffering from trichinosis. The only certain method of establishing the diagnosis is the demonstration of larvae by muscle biopsy; this was obtained in 16 cases, and included three patients with milder disease treated at home. In most of those patients in whom a muscle biopsy was not carried out the diagnosis was easy to make clinically, as they presented a clear history, together with typical physical signs, and showed a marked eosinophilia. In the absence of eosinophilia the diagnosis was made only in exceptional circumstances, but it was found that four patients in whom larvae were found on muscle biopsy had normal eosinophil counts on the 11th-17th day of disease. All cases doubtful on clinical grounds were excluded.

The incidence of the symptoms presented by 82 patients is given in Table III, and it will be seen from this list that these varied considerably from case to case. The classic

TABLE III.—*Incidence of Symptoms in 82 Cases*

	No. of Cases	%		No. of Cases	%
Swelling of eyes ..	82	100	Delusions and light-headedness ..	9	11.0
" " face ..	61	74.4	Splinter haemorrhages under nails ..	8	9.8
Muscular pains ..	77	94.0	Diarrhoea ..	7	8.5
Headache (frontal in 64 cases) ..	72	87.8	Cough ..	7	8.5
Photophobia ..	54	65.9	Conjunctival haemorrhage ..	5	6.1
Insomnia ..	46	56.1	Swelling of legs ..	3	3.7
Constipation ..	29	35.4	Semicomatose ..	2	2.4
Neck stiffness ..	26	31.7	Cerebellar signs ..	1	1.2
Lethargy ..	26	31.7	Monoplegia ..	2	2.4
Vomiting ..	24	29.5	Wrist-drop ..	1	1.2
Disturbance of balance or dizziness ..	23	28.0	Coma ..	1	1.2

picture of an illness of infection or a gastro-intestinal upset, followed 10-14 days later by general symptoms, was seen in only two cases. In spite of this, many of our patients presented a somewhat similar history, and the following is a detailed description of the commonest signs and symptoms.

Signs and Symptoms Commonly Seen in Patients During the Outbreak

Onset.—In most cases this was sudden, the usual story being that of a patient noticing marked swelling of the eyelids on waking one morning. This swelling was the only finding constant in every patient, and varied from puffiness just below the lower eyelids to gross oedema of the eyelids spreading on to the face, sufficient almost to obscure the eyes. It was usual for the oedema to increase for two to three days and then to disappear more gradually. The oedema became more noticeable after the patient had been lying in bed for some hours. Patients almost invariably have had some pyrexia at the time of the swelling of the eyes, and the temperature most commonly was in the range 100-103° F. (37.8-39.4° C). Some pyrexia often persisted for two to three weeks, and usually the temperature gradually subsided over this period.

Headache.—This was present in 72 patients (87.8%), was mainly frontal, and was located by many as being behind the eyes. It usually began after the swelling of the eyes had been present for about 24 hours; in a few persons, however, headache did not develop till a few days later. Headache was a distressing symptom; many patients described it as severe and likened it to a feeling as if the

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FIG. 1.—An area of early polymorphonuclear and eosinophilic infiltration between heart muscle fibres. ($\times 120$.) FIG. 2.—A small area of necrosis of heart muscle fibres. ($\times 40$.) FIG. 3.—Showing a partially developed larva bent upon itself and lying longitudinally in the axis of the muscle fibres in an unstained fresh preparation. Seen with some difficulty. ($\times 54$.) FIG. 4.—Showing a more developed larva arranged spirally in the muscle in an unstained fresh preparation. A cyst wall has not yet been formed. ($\times 54$.) FIG. 5.—Showing a nearly mature larva in the muscle digest. ($\times 54$.) FIG. 6.—Showing a larva lying in the muscle in a fusiform focus of necrosis with cellular reaction at each end. The cavity in which the coiled-up larva lies is probably an artifact and probably does not represent the early stages of formation of the cyst. ($\times 54$.)

P. JEWELL, T. PILKINGTON, AND B. ROBINSON: HEPARIN AND ETHYL BISCUUMACETATE IN PREVENTION OF VENOUS THROMBOSIS

FIG. 1.—Section of an ear vein showing a small mural thrombus. Rabbit had received ethyl biscoumacetate. (H. and E. $\times 60$.) FIG. 2.—Section of an ear vein showing complete occlusion. Rabbit had received heparin. (Picro-Mallory. $\times 50$.)

front of the head was about to burst. Photophobia usually accompanied this violent headache and lasted often for four to five days.

Muscular Pains.—These nearly always first occurred two to four days after the swelling of the eyes, and varied considerably from case to case, but the intensity of muscular pain did not seem to depend upon the severity of the case. Patients found it unusually difficult to describe the type of pain which they experienced; the most commonly used descriptions were those of a "stiffness type of pain" or of a "heavy dull pain," and many patients reported that their pains increased on movement, especially on moving a muscle after rest, although when the muscle was further exercised the pain became less apparent and often disappeared. In this way patients themselves noticed that their muscular pains were similar to those felt in muscles following unusual exercise, such as the pains experienced by any athlete at the beginning of a new season of sport. Muscular pains have not been the predominating symptom of most patients, although they were very acute in a minority. In most persons the severe headache usually developed before the muscular pains, and was more troublesome.

Insomnia.—At the start of their illness 46 patients (56.1%) suffered from marked insomnia. This finding was commented upon by patients and relatives who, having noticed that the patient was very lethargic and found concentration difficult, were surprised at the difficulty in sleeping. This insomnia has been a characteristic of so many patients that it has suggested a useful additional diagnostic sign, for, in most persons, the insomnia could not be explained satisfactorily by the symptoms, and represented an obvious feature of its own.

At the end of the first week of illness, the swelling of the eyes had largely disappeared and the picture in most cases was that of a persisting pyrexia, with some muscle pains and marked lethargy and weakness, and this condition usually then slowly improved until after two to three weeks the patient was free from symptoms although still feeling very weak.

Splinter Haemorrhages.—Splinter haemorrhages under the finger-nails as described by Sheldon (1941) were seen in

FIG. B.—Splinter haemorrhages under nails.

eight cases (9.8%). In all instances these haemorrhages developed late in the disease (second and third weeks) and therefore were of no value in early diagnosis. Characteristically, the haemorrhages occurred under the

tips of the nails (see Fig. B), and in all but one patient they occurred under all the finger-nails.

Eosinophilia.—Apart from four persons, in all of whom larvae were demonstrated by muscle biopsy, an eosinophilia was present in all cases, varying from 550 to 12,000 eosinophils per c.mm.

Other Signs and Symptoms.—Constipation was reported in 29 cases (35.4%), and was a much commoner finding than diarrhoea (7 cases, 8.5%). Vomiting occurred in 24 patients (29.5%), and was usually of short duration, being most commonly reported on the first and second days of the illness. Lethargy was a very obvious feature of 26 cases (31.7%), although a much larger number reported that they felt tired and washed out. Neck stiffness was reported in 26 persons (31.7%), and included in roughly equal proportions a stiffness when moving the head antero-posteriorly and from side to side.

Complications in Central Nervous System

In five patients (6.1%) obvious abnormal central nervous system signs developed. In four these began at the end of

the first week of illness and in the other at the end of the second week. One patient developed signs of cerebellar involvement and later a monoplegia; another quickly lapsed into coma, adopting a meningeal position and cry. A further case developed a wrist-drop. Two additional patients lapsed into a semicomatose state and remained critically ill for one to two weeks—one of these also developed a monoplegia. In the five cases with C.N.S. involvement lumbar puncture showed no abnormality.

Nine cases showed minor psychic disturbances, with either delusions or an obvious personality change; these findings resulted in one family considering seeking psychiatric advice, while three patients confessed that they thought they must be going mad. The personality changes mainly took the form of the patient behaving in an unusual manner. One sang constantly; another climbed out of bed and calmly urinated on the floor. Hallucinations and visual disturbances were not reported.

Disturbances of balance mainly associated with dizziness occurred in 23 cases (28.0%). This was not a troublesome symptom and usually cleared up within a few days.

Cardiac Complications (Including Details of a Fatal Case)

In the whole series there was one fatal case (see below). Another patient died from a pulmonary embolism during the third week of the disease.

Report of Fatal Case.—A man aged 45 began his attack on November 3 with sudden swelling of the eyes; frontal headache developed a day later. The initial part of his illness lasted one week, at the end of which he began to suffer from cramp-like pains in the back of his neck. At this stage his family had become extremely worried on account of his unusual behaviour. On November 17 he noticed that his right hand felt very heavy and that he was unable to lift it up.

He was admitted to hospital on November 20, and on examination was found to have a right wrist-drop, but, with the exception of a doubtful positive Babinski sign, no additional abnormalities were found in his central nervous system. Lumbar puncture findings were normal. He had a low-grade pyrexia, and on November 21 a blood count showed an eosinophilia of 3,800 cells per c.mm. He was treated with cortisone, 100 mg. daily, beginning on November 21. By the 23rd an obvious improvement in the condition of his right hand was noticeable as well as in his general condition. Next day he felt further improved, had breakfast, but, on sitting up, suddenly collapsed and died within a few moments.

At necropsy, no abnormality was found on naked-eye examination in any organ except the heart, which showed moderate left ventricular hypertrophy. Patchy atheroma was present in the coronary arteries, but complete occlusion was not found.

Histological examination of the heart showed a widespread focal destruction of the muscle fibres with an acute inflammatory reaction, the cells consisting of polymorphonuclear leucocytes with a high proportion of eosinophils (Plate, Figs. 1 and 2). The foci varied in size, some consisting of small clusters of inflammatory cells, others being about 1 mm. in diameter. The foci seemed to be of different ages, the youngest being at the stage of cellular infiltration, the oldest showing the changes of early organization. No parasites were found in any of these foci, nor were masses of foreign material seen which might have been the remnants of partially absorbed parasites.

Sections of the voluntary muscle of a limb showed a much more marked eosinophilic and polymorphonuclear leucocytic infiltration, but no focal areas of necrosis were found such as occurred in the cardiac muscle. In contrast, the cells were widely scattered between the individual muscle fibres and separated them. Larvae were found in fusiform gaps between muscle fibres which contained an inflammatory reaction at both ends. No cysts had formed. Neither parasites nor tissue reactions were found in sections in any other organ, including the brain.

The absence of any abnormal macroscopic signs at necropsy to account for this patient's sudden death suggested that he might have died from a sudden failure of the heart similar to that seen occasionally in diphtheria, and the subsequent microscopical findings supported this theory. Consequently a very careful watch was kept for any other patients developing signs late in their illness suggestive of a possible heart failure.

Three cases of sudden unexplained breathlessness beginning at the end of the third week of illness were traced.

All these patients had an obvious breathlessness and one had oedema of the legs, but there was no venous congestion in any of them and all had a regular rhythm of the heart. All did, however, show some tachycardia of 110-120 a minute. Unfortunately, further detailed examinations, including E.C.G. tests, were not carried out.

When the findings of these cases are considered in conjunction with the microscopical findings in the heart muscle of the fatal case, it seems suggestive that unexpected cardiac failure may occur in trichinosis as a late complication, especially towards the end of the third week of the disease. Certainly any unexplained fainting or breathlessness at this stage of the illness, particularly if associated with tachycardia or a low blood pressure, should be taken seriously and the patient nursed in the recumbent position.

It is interesting to consider the possible causation of the myocarditis in the fatal case, which occurred two to three weeks after the first larvae had migrated from the bowel. As no larvae were found in the heart muscle it is unlikely to be a direct reaction to their continued presence. It is usually believed that the larvae encyst mainly in the muscles with a high metabolic rate, such as the oesophageal muscle, diaphragm, and the intercostal muscles. The fate of other larvae in the rest of the body—and there must be a very large number of them—is unknown. By analogy with experimental animal infections with trichinellae, destruction of the larvae in muscles of low metabolic rate would occur from the second week onwards. This raises the possibility that the myocarditis occurred at the time of larvae destruction in the heart muscle and may have been due to the products of destruction.

Sequelae

Fifty-two of the cases were followed up by health visitors four to six weeks after their illness. Only 15 of these patients reported that they felt fully recovered. The majority complained of tiredness and lack of energy, and 24 had not returned to work. Nine of the group had some transient breathlessness which lasted a few days, developing in every case from the third to fifth week. Further visits were paid to all patients still showing some symptoms, and at the time of writing this report 16 were still being visited. The general picture is of an exhausting debilitating disease from which recovery is very slow.

Laboratory Investigations

The methods used in examining the muscle are described in detail, since it is only by this means that the diagnosis can be established with certainty in a suspected clinical infection. A piece of muscle about 2 c.cm. in size was removed under local or general anaesthesia from the deltoid or the outer aspect of the thigh, or wherever local symptoms suggested, with due regard to cosmetic results. A small flat disk about 5 mm. in diameter, with the muscle fibres running along the surface, was pressed between two glass slides until it was about 2 cm. in diameter, and examined unstained under the low power of the microscope. Coiled larvae were usually seen clearly, but the smaller earlier stages, which have less well-defined morphological features and which lie along the axis of the muscle fibres, were seen only with difficulty. In a heavily infected case a larva was usually found in a few minutes, but in others half an hour or an hour was spent before one was found. As will be seen from Table IV in seven cases no larvae were found by direct examination, though they were found in a digest.

Digestion of the muscles was done in all cases. A weighed quantity about 2-5 g. was cut into small fragments and incubated overnight in 250 ml. of 1% acid pepsin, then centrifuged and a little formol saline added to the deposit. The fixed deposit was examined in a "perspex" cell 4 cm. by 3 cm. by 3 mm. on a inverted microscope. Since the larvae are much heavier than the debris, they can be

TABLE IV.—Results of Muscle Biopsy

Patient	Direct Film	Digestion	Larvae per g. of Muscle	Nature of Illness
1	Larvae present	15 larvae in 2 g. muscle	7.5	Moderate
2	Nil	40 " " 2 " "	20	"
3	Larvae present	12 " " 3.5 " "	3.4	"
4	" "	58 " " 1.2 " "	48.3	"
5	" "	19 " " 1.3 " "	14.6	Severe
6	Nil	66 " " 2 " "	33	"
7	" "	6 " " 5.3 " "	1.1	Moderate
8	Larvae present	511 " " 4.3 " "	118.6	Severe
9	Nil	1 larva in 1.6 " "	<1	Mild
10	Larvae present	23 larvae in 1.4 " "	16.4	Moderate
11	" "	1 larva in 1.19 " "	<1	"
12	Nil	1 " 1.5 " "	<1	"
13	" "	1 " 1.6 " "	<1	"
14	Larvae present	131 larvae in 1.6 " "	81.8	Severe (died)
15	Nil	2 " " 3.62 " "	<1	Moderate
16	Larvae present	64 " " 3.01 " "	21.3	"

seen clearly as refractile objects with definite morphological characteristics lying on the bottom of the cell against the vague background of the debris (Plate, Figs. 3, 4, 5, and 6).

Summary

An outbreak of trichinosis is described which occurred in Liverpool in the late autumn of 1953 and involved 82 persons.

Infection was traced to sausages in most cases. In two instances pork roasted at home was responsible. Although epidemiological investigation traced the infection to a particular carcass of pork, it was impossible to trace this finding back to a piggery, as no records existed to enable this to be done. There is an obvious need for such records to be kept by the Ministry of Food.

Women were affected more often than men (60 to 22). Analysis of the eating habits of 3,412 housewives in Liverpool showed that 16.1% habitually ate raw sausage.

The symptomatology of 82 cases is considered in detail. Oedema of eyelids, headache, muscular pains, pyrexia, photophobia, and insomnia were the most commonly reported signs and symptoms.

A fatal case is recorded, together with the post-mortem findings. The complication of myocarditis developing in the second and third weeks of disease is considered, and it is emphasized that any suggestion of cardiac involvement should be treated seriously and the patient nursed in a recumbent position, as there is a possibility of sudden death.

Larvae were isolated from the muscles of 16 patients.

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