Contemporary Themes

Prevalence of Infective Ova of Toxocara Species in Public Places

O. A. BORG, A. W. WOODRUFF

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Summary

Out of a total of 800 soil samples from public places all over Britain ova of Toxocara species were found in 24·4%. Ova from 20 samples were incubated and active embryos developed in all; these were fed to eight mice and active larvae were later recovered from the livers of six. Some children living near these parks had become infected with toxocara. Clearly more control of pollution of public places by dogs and cats is needed.

Introduction

Within the past 10 years work has been carried out in this department on the clincial features of toxocariasis in man and animals. A diagnosis of toxocariasis in man is still relatively novel, for when this work was begun only seven cases had been reported from Britain, all affecting the eye.[1] Successive investigations, however, have shown that there is a large reservoir of infection with this parasite in dogs and cats and that it is not uncommonly transmitted to man. About 2% of the apparently healthy population show immunological evidence of past infection.[2] In most of these infections the parasite produces few symptoms, and in all but a few cases questioning discloses no past illness which can clearly be identified as toxocaral in origin. Nevertheless, in the unfortunate minority in whom the larvae have entered vital organs such as the eye or brain, symptoms such as loss of vision or epileptiform attacks may result, and until now almost 50 patients have passed through the medical unit at the Hospital for Tropical Diseases in whom there was good clinical and immunological evidence that toxocaral infection was the cause of their ophthalmic disease. Only about half of these gave a clear history of having had a dog or cat in their household and this posed the question about how they had become infected.

Infection in man is acquired by swallowing the ova of *Toxacara canis* or *T. cati*, and these ova are contained within the faeces of infected dogs and cats respectively. As such faeces is commonly deposited on and contaminates soil the soil in parks and places frequented by dogs constitutes a possible source of infection, particularly to children. We therefore decided to examine specimens of soil from such sources to determine whether contamination was present and if so how often. The investigations undertaken showed that many soil samples contained *T. canis* ova, and further experiments were carried out to determine whether these ova were living and if so whether they could produce active infection.

Department of Clinical Tropical Medicine, London School of Hygiene and Tropical Medicine, and Medical Unit, Hospital for Tropical Diseases, London N.W.1

O. A. BORG, M.B., PH.D.,
A. W. WOODRUFF, M.D., F.R.C.P., Director

Methods

Specimens of soil were collected from public parks in widely separated areas throughout Britain, from Glasgow in the north to Brighton in the south, and from Cardiff in the west to Norwich in the east. Samples of about 250 g were collected in two series, one in summer and the second in winter. Most samples were collected from places not less than 200 yards (183 m) apart. The samples were examined in the laboratory by the zinc sulphate flotation method. One part soil was triturated with 10 parts tap-water and after thorough shaking was centrifuged at 2,000 r.p.m. for one minute. The supernatant was poured away and the process repeated. Zinc sulphate solution of specific gravity 1·180 (33%) was then added till the tube required only 1 ml to fill it completely. The tube was shaken, allowed to stand for 10 minutes, and six bacteriological loopfuls from the solution at the surface were removed to a microscope slide and examined.

Samples of ova were incubated in the laboratory at room temperature to determine whether the embryophores within them differentiated into lavae. When such differentiation occurred samples of the ova were fed to mice which were killed four days later, and any lavae present in their livers were recovered by the Baermann funnel technique.

Children attending day nurseries near parks from which samples had been taken were examined for evidence of infection by means of the toxocaral skin sensitivity test as developed and described by Woodruff.[2]

Results

SOIL SAMPLES

Of the 800 samples collected 24·4% were shown to contain *T. canis* or *T. cati* ova. Altogether 400 of these samples were collected during May, June, and July and 400 during December, January, and February; 23·3% of those collected in summer and 25·5% of those collected in winter contained ova. A difference which clearly is not statistically significant (table I). Positive results were obtained from all the regions investigated.

TABLE I—*Numbers of Soil Samples collected in Public Places containing Toxocaral Ova*

Site of Soil Collection	Summer		Winter	
	No. of Samples Collected	No. of Samples Containing Ova	No. of Samples Collected	No. of Samples Containing Ova
London				
Park 1	40	10	40	12
Park 2	40	15	40	16
Park 3	40	10	40	11
Park 4	40	8	40	9
Park 5	40	8	40	9
Birmingham	40	10	40	10
Norwich	40	8	40	9
Cardiff	40	10	40	10
Glasgow	40	11	40	12
Brighton	40	3	40	4
Total	400	93 (23·3%)	400	102 (25·5%)

VIABILITY AND INFECTIVITY OF OVA IN THE SOIL

Ova collected from the Downs near Brighton, from two parks, and from one children's play centre in central London were incubated in the laboratory, and movement indicating viability of the contained larvae was observed in all of them. The soil from the play centre was collected from under the swings. Of 20 specimens of soil from parks in London tested at intervals of two weeks up to a maximum of nine months embryonation was found in ova from all samples within the first 16 weeks of observation.

From eight pooled samples of soil collected from a park in central London and weighing 2 kg in all, ova were concentrated and an aqueous suspension containing 100 ova per m, was prepared. A 0·5 ml (50 ova) sample was fed by stomach tube to each of nine mice which weighed about 25 g each. These were killed after four days, and the pooled livers, lungs, and brain of six mice were found to contain second-stage toxocaral larvae. Clearly the soil from this park contained toxocaral ova which were viable and able to cause infection (figs. 1, 2, and 3). The ova in soil collected from this park were in no way different from those collected elsewhere. *T. canis* ova are remarkable for their longevity and resistance; they have, in fact, been kept in 1% formol saline in the laboratory for as long as four years and the larvae within them at the end of this period have been living and moving. This experiment has been repeated with soil samples from two other London parks and from a children's play centre in London. Toxocaral ova from all sites have been found to infect mice.

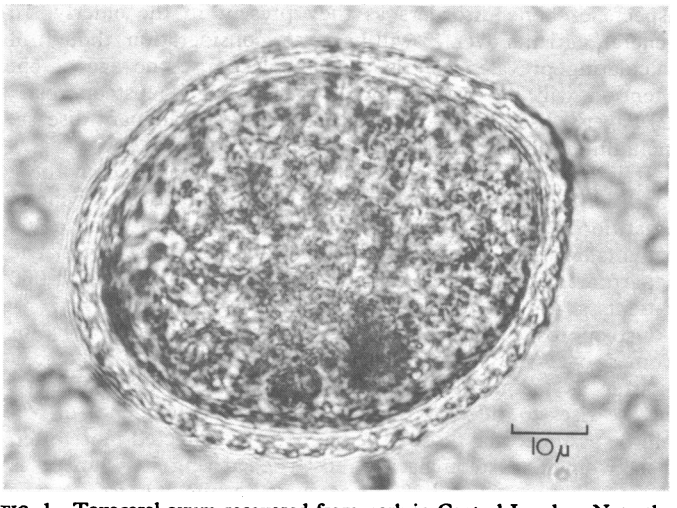

FIG. 1—Toxocaral ovum recovered from park in Central London. Note the typical pitting of shell.

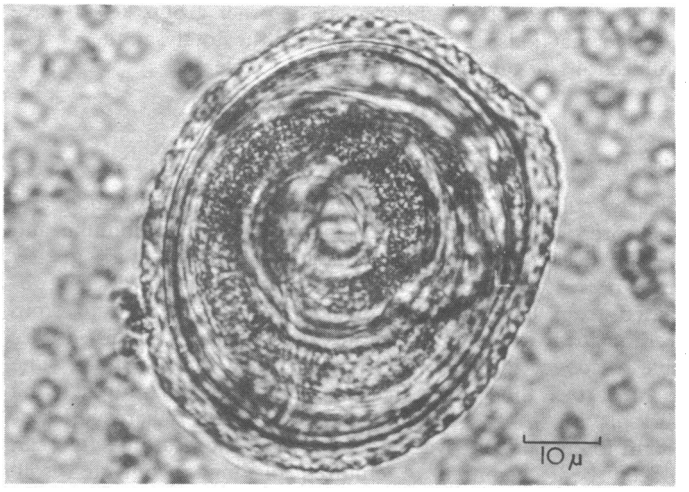

FIG. 2—Toxocaral ovum from London park after incubation in the laboratory. Note the well-differentiated lava.

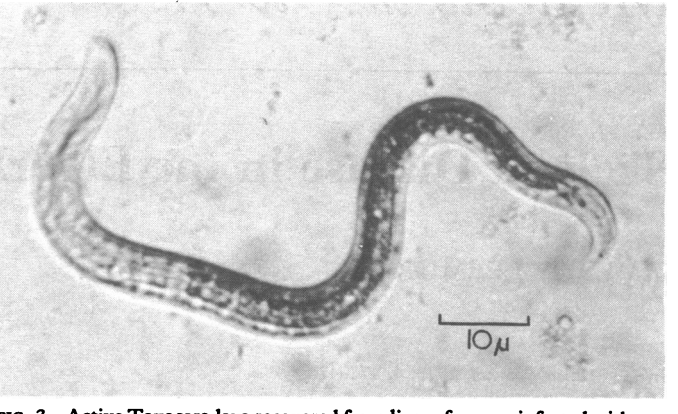

FIG. 3—Active Toxocara lava recovered from liver of mouse infected with ova from soil obtained in London park.

TABLE II—*Numbers of Children with Positive Reaction to Toxocaral Skin Test*

Source and Age Last Birthday (years)		No. Tested	No. Positive
London day nursery 1	2	5	0
	3	17	0
	4	13	0
Total		35	0
London play centre 2	2	7	1
	3	10	0
	4	15	3
	5	25	2
	10	8	1
Total		65	7
London children's club	2	4	0
	3	11	0
	4	15	0
Total		30	0
London children's "workshop"	2	8	0
	3	15	0
	4	17	0
Total		40	0
Grand total		170	7

PREVALENCE OF RELATED HUMAN TOXOCARAL INFECTION

Among children living near the parks examined the toxocaral skin test was carried out on 35 2-5-year-olds attending a local day nursery, on 65 2-15-year-olds attending a play centre, on 30 2-5-year-olds attending a children's club, and on 40 children attending another "workshop." Of the 65 children attending

one of the play centres 7 gave positive reactions to toxocaral skin tests; none of the children in the other groups tested gave positive reactions. Thus from among the total sample of 170 children 4·1% gave positive reactions (table II).

Discussion

Clearly pollution of soil with toxocaral ova is common and widespread; no region in Britain appears to be immune and the prevalence of such contamination does not vary greatly from region to region or from season to season. Evidence obtained from incubating the ova in the laboratory and from feeding them to animals indicates that toxocaral ova in soil are able to convey infection to animals, and therefore to man. The third part of this work—that is, the testing of children living and playing in the neighbourhood of parks where soil was found to contain the ova—indicates that toxocaral infection can indeed be transmitted to children playing on infected soil. Among those with a positive reaction to the toxocaral skin test the precise place or places where infection had been acquired must remain conjectural, but the significant points are that infection is being transmitted to them and that soil is an important source of infection. The control of pollution by dogs and cats of soil in public places used by children would be one way to prevent such infection. Moreover, those playing on contaminated or potentially contaminated soil or sand should wash their hands afterwards, and particularly before consuming food. This simple measure might also be applied to those handling soil while gardening. Clearly increasing attention should be given to the hygienic control of dogs and cats to prevent them contaminating public places with infective excreta; owners should ensure that their animals are free from infection and are not a public danger.

References

[1] Ashton, N., *British Journal of Ophthalmology*, 1960, **44**, 129.
[2] Woodruff, A. W., *British Medical Journal*, 1970, **3**, 663.

Medicine in Old Age

Skeletal Disease in the Elderly

JAMES T. LEEMING

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Much useful research is being carried out on bone disorders and bone physiology at present and our understanding of the relevant metabolic processes is expanding rapidly. Though this increased knowledge has greatly increased our awareness of the aetiological and therapeutic possibilities, in general it has not yet had a great impact on routine diagnosis and treatment. Two examples of these advances are worth citing—namely, the discovery of the hormone calcitonin, produced in the thyroid gland, and the advances in knowledge concerning vitamin D metabolism.

Calcitonin inhibits bone resorption and thus counterbalances the effect of parathyroid hormone. Other substances, such as glucagon and gastrin stimulate the release of calcitonin. It is not yet known, however, how important these interrelationships are in the average person—whether reduced production of calcitonin is a major factor in producing osteoporosis, or whether established oesteoporosis can be effectively treated with it.

Advances in knowledge of vitamin D metabolism have been equally impressive. Vitamin D_3 (cholecalciferol) is now known to be converted in the liver to another substance (25-hydroxy-D_3) and the kidneys then convert it yet again into two further compounds (1, 25-dihydroxy-D_3, and 21, 25-dihydroxy-D_3), the first of which acts on bone more quickly than the second. These discoveries open up immense new possibilities regarding the pathogenesis and treatment of vitamin D deficiency, but it is too early yet for them to affect routine clinical practice.

University Hospital of South Manchester, Manchester M20 8LR
JAMES T. LEEMING, M.D., F.R.C.P., Consultant Geriatrician

Practical Aspects

The remainder of this article will concentrate on practical aspects of bone disorders as they present in the elderly. In general, patients over 75 will be under consideration, though in calculating prevalence it is convenient to use the age of 65. Mention will be made of four conditions: (1) osteoporosis; (2) Paget's disease; (3) osteomalacia; and (4) malignant disease, including multiple myeloma.

It is important to consider the frequency with which these conditions are likely to occur in an average practice. A general practitioner's list of 3,000 patients will be assumed to have 360 patients over the age of 65 (220 women and 140 men). A geriatric department serving a population of 240,000 and admitting 1,000 patients a year will be assumed to serve 80 G.P.'s.

Osteoporosis, with a liability to fracture, affects 25% of women over the age of 65, and men are probably affected a quarter as frequently as women. The incidence of Paget's disease rises to 10% by the age of 90, so an incidence of 6% will be assumed for those over 65. Men are affected more often than women. Osteomalacia, mostly occurring in women, is found in between 1 and 4% of geriatric hospital admissions (the higher figure in Glasgow and the lower figure in the south of England).

By using these figures and assumptions it will be expected that a general practitioner with a list of 3,000 will have on his list 70 patients with osteoporosis (55 women and 9 men), 20 patients with Paget's disease (about 12 men and 8 women), and that he will see a case of osteomalacia once every two to eight years. The incidence of malignant disease of bone has not been calculated but will not be high.

In the table the incidence of these conditions is compared and they are placed very broadly in order with regard to preventability, treatability, and seriousness if untreated.