Seroprevalence of toxoplasma antibody in a Toronto population

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OBJECTIVE: To determine the prevalence of infection with toxoplasmosis by country of birth and age in a sample of convenience.

DESIGN: Banked sera and the computerized data base of demographic and other factors from an earlier epidemiological study were retrieved.

SETTING: Thirty-eight infant-toddler day care centres in Toronto.

POPULATION: Day care providers from whom informed consent was obtained and banked sera were available.

MAIN RESULTS: Of the 124 providers whose serum was tested, 16 (12.9%) were seropositive. Of those providers born in Canada, 8.2% were seropositive, while of those born outside of Canada, 19.6% were positive ($P=0.067$, OR 2.68, 95% CI 0.91, 7.94). While there was no significant association of seropositivity with age, the association of seropositivity with country of birth was different in the providers under 30 years of age. Among those born in Canada, 4.6% were seropositive, while among those born outside of Canada 23.1% were seropositive.

CONCLUSIONS: The data supplement the limited existing data on toxoplasmosis infection in Canada. Among Canadians, those born outside of Canada were more likely to be seropositive than those born in Canada, suggesting that there may be a differential risk of congenital infection for infants whose parents were born outside of Canada.

Key Words: Day care, Seroprevalence, Toxoplasmosis

Séroprévalence de l'anticorps anti-toxoplasma dans une population de Toronto

OBJECTIF : Déterminer la prévalence de la toxoplasmose selon le pays d'origine et selon l'âge dans un échantillon de commodité.

MODÈLE : Sérum mis en réserve et base de données informatisée des facteurs démographiques et autres, à partir d'une étude épidémiologique antérieure.

CONTEXTE : Trente-huit garderies de Toronto.

POPULATION : Préposés aux garderies de qui un consentement éclairé a été obtenu et chez qui on a prélevé des échantillons sériques mis en réserve.

PRINCIPAUX RÉSULTATS : Parmi les 124 moniteurs dont le sérum avait été prélevé, 16 (12,9 %) étaient séropositifs. Parmi ceux d'origine canadienne, 8,2 % étaient positifs, alors que chez ceux qui étaient nés à l'extérieur du Canada, 19,6 % étaient positifs ($P = 0,067$, RR 2,68, IC 95 % 0,91, 7,94). Si aucune association significative de séropositivité n'a pu être établie avec l'âge, l'association de la séropositivité avec le pays d'origine a été différente chez les moniteurs de moins de 30 ans. Parmi les moniteurs nés au Canada, 4,6 % étaient séropositifs, alors que parmi ceux qui étaient nés à l'extérieur du Canada, 23,1 % l'étaient.

CONCLUSIONS : Les données complètent les résultats limités existants sur la toxoplasmose au Canada. Parmi les Canadiens, les gens d'une autre origine étaient plus susceptibles d'être séropositifs que les Canadiens d'origine, ce qui donne à penser qu'il pourrait y avoir un risque différentiel d'infection congénitale pour les nourrissons dont les parents sont nés à l'extérieur du Canada.

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Congenital toxoplasmosis results from a primary maternal infection during or in the weeks immediately preceding pregnancy. In uncontrolled studies, maternal therapy for acute infection appears to reduce the incidence and severity of fetal disease (1). More recently published data suggest very encouraging results from therapy for infected infants with a combination of drugs including pyrimethamine, sulfadiazine and folinic acid. A substantial reduction in auditory and cognitive morbidity has been noted in comparison with historical controls (2). Although most infected infants are asymptomatic at birth, nearly all will have chorioretinitis and other neurological defects before 20 years of age (3,4). Even at birth, approximately 40% of these asymptotically infected infants have chorioretinitis or cerebral calcifications, if investigated ophthalmologically and with cranial imaging (5).

To identify all infected fetuses or infants early in life when therapy appears to be effective requires a screening program to identify either infected mothers during pregnancy or their infants at birth. Before introduction of either program, knowledge of the incidence of the disease is required so that the cost per case detected can be determined. High seroprevalence in a population indirectly suggests a high rate of acquisition that would be important during the child-bearing years. We therefore undertook a study of a population of Toronto day care providers for whom we had banked sera and a computerized data base, including date and country of birth from an earlier cytomegalovirus (CMV) survey, to determine the seroprevalence of toxoplasmosis.

METHODS

Informed consent: Providers from 38 infant-toddler centres in Toronto, Ontario who had participated in a study of CMV seroprevalence were considered eligible. Information about the study was provided and informed consent obtained at the centre or by telephone. Consent was obtained at the centre if providers worked at centres where the research nurse was returning (to obtain blood from CMV-negative staff for seroconversion) or by telephone, if providers worked at centres where visits were not required by the research nurse. Information regarding the study was mailed to the centre before the visit or telephone call to obtain consent.

Computerized data regarding day care providers: Data regarding the providers' personal history including country of birth, language spoken at home, age, day care employment history and information about hygienic practices had been obtained through a self-administered questionnaire and entered into a computerized database at The Hospital for Sick Children in Toronto, Ontario.

Banked blood samples: Sera remaining from the CMV seroprevalence study had been stored at -20°C at The Hospital for Sick Children.

Serological testing: Toxoplasmosis testing was undertaken at the Ontario Provincial Laboratory in Toronto, Ontario, with screening by Latex Agglutination (Toxotest MT, Tanabe, California) and confirmation by immunofluorescent antibody (IFA) (GenBio, General Biometrics, California). A positive test was reported if the result was greater than 1:16.

TABLE 1
Seroprevalence of toxoplasmosis by region of birth, Toronto Child Care Study, 1993

Region	Seropositive (%)	N
Africa	0	3
Asia	1 (14.3%)	7
Caribbean	1 (11.1%)	9
Europe	5 (20%)	25
North America	6 (8.3%)	72
South America	3 (42.9%)	7
Total	16 (12.9%)	123

Statistical analysis: Relationships between seropositivity and providers were explored using the χ^2 statistic (Fisher's exact χ^2 where sample sizes were small) and odds ratio (OR) with 95% CI. All analysis was carried out using SAS statistical software.

RESULTS

Computerized data were available for 206 day care providers who had direct contact with infants and toddlers for more than 10 h/week. Consent for testing was provided and sera obtained in 1993 were available for 124 providers (60.2%). There were no significant differences between the study group and the other 40% of the providers in the original study ($P>0.25$ for all demographic and work-related variables). Sixteen providers tested positive for a seroprevalence of 13%. Of the 123 providers for whom country of birth was provided, 72 were born in Canada and 51 were born outside of Canada; the respective seroprevalence was 8.2% and 19.6% ($P=0.067$, OR 2.68, 95% CI 0.91, 7.94). Seroprevalence by region of birth is shown in Table 1 and the descending order of seroprevalence is South America, Europe, Asia, the Caribbean and North America.

Although seropositive providers were somewhat older than seronegative providers (mean 33.3 years versus 30.5 years), the range of age was similar in the two groups (19 to 55 years versus 18 to 53 years) and there was no significant association of seropositivity with age. Of those under 30 years of age, 11.7% were seropositive, compared with 15.1% age 30 years and over ($P=0.6$). Although the proportion of those born in Canada was not different for those over and under age 30 years ($P=0.35$), the association of seropositivity with country of birth was different for the two age groups. Among the 69 younger providers, seropositivity was 4.6% in the Canadian-born providers and 23.1% in those born outside of Canada ($P=0.02$, OR 6.5, 95% CI 1.14, 33.24). Among the 52 older providers, the respective seropositivity rates were 14.3% and 16.7% ($P=0.4$, OR 1.2, 95% CI 0.27, 5.42).

In this day care provider population, there was no significant relationship of seropositivity with work history (employment in child care five years or more, employment at present centre less than 1.5 years, working with infants only), size of the child care centre (25 children or more) or hygienic factors (gloves not worn during diaper changes in day care, cloth ver-

sus disposable diapers). Because this was a sample of convenience to ascertain seroprevalence, information about known risk factors for toxoplasmosis infection, eg, food handling, ingestion practices and kitten exposure was not obtained.

DISCUSSION

Our results suggest an overall low seroprevalence of toxoplasma antibody of 12.9% in this urban, Canadian-born population. Only 4.6% of Canadian-born providers under age 30 years had toxoplasma antibody. There is, however, a greater seroprevalence in those providers born outside of Canada (19.6%), particularly among those who are under 30 years of age (23.1%). In general, infection rates of toxoplasmosis vary widely and depend on factors including culinary practices and geographic location. While a possible tendency to use previously frozen meat, rather than fresh meat, for cooking may explain such differences, the study was not designed to ascertain this information.

Until the mid-1980s, six studies of seroprevalence undertaken in Canada suggested that the prevalence of antibody is approximately 20% to 40%, with higher rates among francophone or immigrant women, presumably because of culinary differences (6,7). In a more recent study of children in Halifax, Nova Scotia, cat ownership was associated with antibodies to *Toxoplasma gondii* in rural children (8). This suggests a possible risk to susceptible pregnant rural women who have cats.

Among vegetarian and nonvegetarian members of different ethnic communities in the lower Fraser Valley of British Columbia, 20.7% had antibody when tested by ELISA immunoglobulin G in a 1994 report (7). There was no difference between Caucasian and nonCaucasian participants or between cat owners and those without cats. There was a significantly higher prevalence (25%) among participants whose occupations were associated with handling of meat and/or cats or who had consumed raw milk. The risk of toxoplasmosis was significantly higher in Caucasians born outside of the country, in Moslems and in Orientals. Eighty per cent of females of all ethnic origins between the ages of 17 and 40 were seronegative (7).

Wide geographic variation in rates of toxoplasmosis infection is well known. Seroprevalence relates more closely to country of birth rather than ethnic origin so that rates of infection are lower among North American- and British-born women than women born in Europe or Africa. Therefore, it may be expected that a diverse population will show different rates of infection, as we have found here. Seroprevalence data

reflect acquisition insofar as they suggest the likelihood of infection. In this small study, acquisition appears to be fairly uncommon, at least for Canadian-born women.

In Canada, there is a lack of good data on the incidence of congenital toxoplasmosis presenting either with symptoms in the newborn period (5) or asymptotically with later development of chorioretinitis (3,4). It has been suggested that 140 to 1400 cases of congenital toxoplasmosis occur per year in Canada with 79 to 280 being severely affected and the remainder having late sequelae (6). In the United States, with an incidence of infection in pregnancy of 0.2% to 1%, the incidence of congenital toxoplasmosis is estimated between one per 1000 and one per 8000 births (9). The lifetime preventable costs are estimated at \$369 million each year (10). We suggest that there is a need for additional epidemiologic data in Canada, on which decisions can be based about screening in pregnancy and infancy, particularly given the diverse culinary practices of a multicultural population.

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