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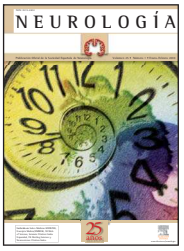

ORIGINAL ARTICLE

Prevalence of multiple sclerosis in Ecuador

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Abstract
Introduction: Multiple sclerosis (MS) is less frequent in areas near the Equator, while the incidence and prevalence rises with increasing distance from this particular area, determining a clear north to south gradient. During the last decade several published reports provide recent data on the prevalence in Latin America. The main objective of this article is to report prevalence data in the three largest cities of Ecuador, a South American Country located on Latitude zero North-South.
Methods: In order to determine the prevalence and other epidemiological variables we conducted a cross-sectional, observational study in the three largest cities of Ecuador. Based on capture and recapture methodology we identified patients with MS who received medical care in the 12 state and private hospitals and in the Ecuadorian Foundation of Multiple Sclerosis (FUNDEM-Quito). The main inclusion criteria to determine the diagnosis of MS was based on the criteria proposed by Poser. For the relative and absolute frequencies calculation, as well as the 95% confidence interval, the EpiInfo 6.01 and EpiDat 3.1 programs were used.
Results: A total of 159 patients were identified in the three largest cities included in the study. In Quito, the capital city: 5.05/100,000 inhabitants (95%CI, 4.03-6.03), Guayaquil, on the coast: 2.26/100,000 inhabitants (95% CI, 1.62-2.91) and Cuenca in the south: 0.75/100,000 inhabitants (95%CI, 0.024-0.175).
Conclusions: Ecuador is a low prevalence country although we believe it is possible that the number of MS cases is underestimated since this is not a population based study. We believe that more studies should be carried out on general populations where the disease has been seldom reported or as non-existent. Important exogenous factors may be involved in the pathogenesis of MS in Ecuador.

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PALABRAS CLAVE
Esclerosis múltiple;
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Prevalencia de esclerosis múltiple en Ecuador

Resumen
Introducción: La esclerosis múltiple (EM) es menos frecuente en las áreas cercanas a la línea ecuatorial, mientras que la incidencia y la prevalencia aumentan conforme se alejan de estas áreas, creando un gradiente norte-sur bien definido. Reportes publicados en la última década proveen datos recientes de la prevalencia en Latinoamérica. El objetivo de este artículo es comunicar las cifras de prevalencia en las tres ciudades más importantes del Ecuador, país localizado en la misma línea ecuatorial latitud N0-S0.
Métodos: Se realizó un estudio observacional transversal en un determinado periodo con el fin de determinar la prevalencia y otras características epidemiológicas de la EM en 12 hospitales de tercer nivel en las tres ciudades principales de Ecuador. Basados en el método captura y recaptura y utilizando una encuesta, se procedió a identificar los pacientes con EM que cumplen los criterios señalados por Poser y que acuden a los principales hospitales estatales, privados y a la Fundación Ecuatoriana de Esclerosis Múltiple (FUNDEM-Quito). Para el cálculo de frecuencias absolutas y relativas, comparación de porcentajes e intervalos de confianza (IC) del 95% se utilizaron los programas EpiInfo 6.01 y EpiDat 3.1.
Resultados: Se identificó a 159 pacientes en las ciudades donde se llevó a cabo el estudio. Quito, la ciudad capital, 5,05/100.000 habitantes (IC del 95%, 4,03-6,03); Guayaquil, en la costa, 2,26/100.000 habitantes (IC del 95%, 1,62-2,91); Cuenca, en el sur, 0,75/100.000 habitantes (IC del 95%, 0,024-0,175).
Conclusiones: Ecuador es un país de baja prevalencia, aunque creemos que hay un subregistro importante del número de pacientes, ya que éste no es un estudio poblacional. Creemos que se deben realizar estudios de prevalencia en poblaciones abiertas y en áreas en que la enfermedad es rara o inexistente. Importantes factores exógenos parecen estar involucrados en la patogénesis de la EM en Ecuador.

Introduction

The prevalence of multiple sclerosis (MS) is characterised by having significant variations, mainly dependent on geographical characteristics.[1] In Latin America, most reports show low or medium prevalence rates with the exception of Uruguay and Brazil,[2,3] which reported figures ranging from 20 to 30 cases / 100,000 inhabitants. It has been shown that cases of MS increase with increasing distance from the equator and most of the few reports have estimated that there are few cases of MS in this particular area. The absence of publications on prevalence studies in most equatorial countries such as Congo, Somalia, Uganda and Equatorial Guinea has prevented an epidemiological point of comparison. This is the first report on the prevalence of MS in Ecuador, a South American country located on the equatorial line itself, latitude N0-S0.

Patients and methods

Ecuador is a South American country with 13,408,270 inhabitants according to the 2006 census[18] and located on the equatorial line, latitude 0.0. To determine the prevalence and other epidemiological variables of MS in Ecuador, we conducted an observational, transversal study between 2nd May and 30th June 2006 in the three main cities of Ecuador.

Quito, the capital, is located in the northern Andean region at 2,816 m above sea level, and has a population of 2,036,260 inhabitants. It has temperatures ranging from 8 to 24 °C and high daily sunlight exposure that lasts from 10 to 15 h.[19] Cuenca, another Andean city, is located in southern Ecuador at an altitude of 2,800 m and has a population of 666,085 inhabitants, with temperatures between 12 and 20 °C and solar luminosity similar to that of the capital. The racial makeup of these two Andean cities consists of a majority of mestizos, few Caucasians and a minority composed of indigenous and Afro-Ecuadorian inhabitants. Guayaquil, the main town in the Ecuadorian coast, is located about 5 m above sea level, with 2,206,213 inhabitants, average temperatures of 25 °C and sunlight exposition ranging between 8 and 12h/day. Its racial composition is dominated by mestizos or Hispanics, Caucasians and minorities (which include fewer Afro-Ecuadorian and indigenous inhabitants than in the mountain regions).

Health services in Ecuador are divided into three levels, from basic primary health care to the third level, comprising more complex hospitals, with specialist physicians and high-tech equipment including magnetic resonance imaging services. These third-level hospitals are where MS patients go for diagnosis and treatment, and there is the possibility of using interferon beta-1a and beta-1b.

Neurologists from the 12 state, private and tertiary hospitals and from the Multiple Sclerosis Foundation

Table 1 Prevalence (100,000 inhabitants) of multiple sclerosis according to city

City	Population	Cases	Prevalence	95%CI
Quito	2,036,260	103	5.05	4.08-6.03
Guayaquil	2,206,213	50	2.26	1.62-2.91
Cuenca	666,085	5	0.75	0.024-0.175

Table 2 General population characteristics by city

	Quito	Guayaquil	Cuenca
Actual age (years)	40.92±11.93 [13-66]	40.02±9.87 [19-75]	33±10.44 [24-50]
Evolution time (years)	5.92±5.14 [0.1-26.9]	6.79±6.53 [0.27-24.42]	5.82±4.44 [0.51-11.26]

The data express mean ± standard deviation [interquartile range].

Table 3 Distribution of cases per gender by city

	Quito		Guayaquil		Cuenca	
	n (%)	p	n (%)	p	n (%)	p
Males	31 (30.09)	0.001	13 (26)	0.001	1 (20)	0.2
Females	72 (69.9)		37 (74)		4 (80)	
Total	103 (100)		50 (100)		5 (100)	

(FUNDEM-Quito) involved in the study agreed to the analysis and manual review of the medical records from patients diagnosed with probable MS. A group of appropriately trained resident physicians completed the forms for demographic data collection, diagnostic tests and treatments received. The form used in Ecuador was previously validated in a similar study in Uruguay.[5] The verification of the diagnosis was subsequently reviewed by a committee composed by neurologists and neuroradiologists involved in MS treatment. The criteria used were those proposed by Poser et al.[4] Patients were classified into one of the following categories: definite MS, probable MS or no MS. The clinical course was classified as relapsing-remitting MS (RR-MS), primary progressive MS (PP-MS), secondary progressive MS (SP-MS) and secondary progressive MS with relapses and remissions (RR/SP-MS).

Prevalence was calculated according to the population projection of the National Statistics Institute of Ecuador in the period defined for the study.[18] Patients considered as prevalent had a diagnosis of MS recorded by the review committee after analysing the medical history and supporting laboratory tests. To calculate absolute and relative frequencies, comparison of percentages and 95% confidence intervals, the programs EpiInfo 6.01 and EpiDat 3.1 were used.

Results

During the study period, there were 159 cases of MS in the health institutions (public, private and FUNDEM) located in three cities in Ecuador that participated in the study; 74.8% of patients had a diagnosis of definite MS, while 25.2% had a classification of probable MS according to the Poser criteria.

Table 1 shows the point prevalence (per 100,000 population) of cases according to the cities in the study. The general clinical characteristics of the study population are described in tables 2 and 3.

In the city of Quito, we found that most of the sample corresponded to the age group between 20 and 59 years (fig. 1). In contrast, most patients were between 30 and 49 years old in the city of Guayaquil (fig. 2).

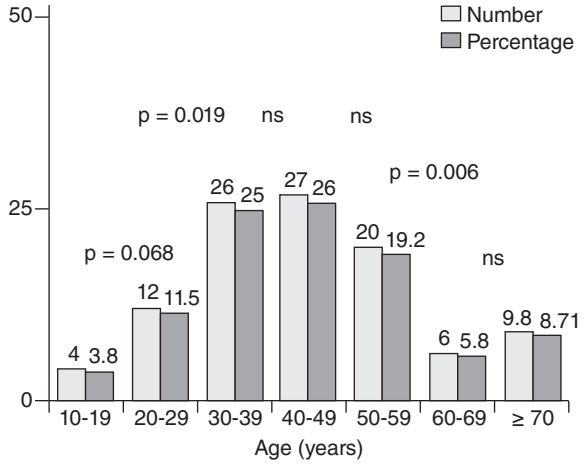

Figure 1 Distribution of cases in the city of Quito, by age group.

Table 4 Distribution of MS clinical forms by city

City	PP, n (%)	p	RR, n (%)	p	SP, n (%)	p	RR/SP, n (%)	Total
Quito	7 (7.4)	0.001	62 (66)	0.001	20 (21.3)	0.002	5 (5.3)	94
Guayaquil	—	—	38 (84.4)	0.001	2 (4.4)	NS	5 (11.1)	45
Cuenca	—	—	2 (50)	NS	—	—	2 (50)	4
Total	7 (4.89)	0.001	102 (71.32)	0.001	22 (15.38)	NS	12 (8.39)	143

NS: no statistical significance; PP: primary progressive; RR: relapsing-remitting; SP: secondary progressive.

Table 5 Studies on prevalence in Latin America

Cristiano et al, 1999	Argentina	12/100,000	Capture-recapture method
Callegaro et al, 2001	Brazil	15/100,000	Community study
Barahona et al, 2004	Chile	11.7/100,000	Community study
Ketzoiandal et al, 1996	Uruguay	20.9/100,000	Capture-recapture method
Sanchez JL et al, 2000	Colombia	1.4-4.98/100,000	Capture-recapture method
Corona et al, 1996	Mexico	5/100,000	Hospital study
Toro Jaime et al, 2007	Bogotá, Colombia	5/100,000	Hospital study

For the city of Cuenca, we found 2 patients in the age range of 21-30 years, 2 patients between 31 and 40 and 1 patient in the interval 50-59 years. Relapsing-remitting MS was the most common for the three cities, followed by SP-MS (table 4).

With regard to clinical presentation, 71.3% of cases were RR-MS, whereas SP-MS and PP-MS were less frequent.

Discussion

Since this is not a general population study, we can say that the estimated prevalence for the cities of Quito and Guayaquil is similar to those described in neighbouring countries such as Colombia.[21] The low prevalence found in the city of Cuenca may be due to the fact that there are few specific referral and treatment centres compared with the other two cities. However, we believe that there is a general underestimation of patients with MS, given the methodology used, the lack of specific referral centres and the structure of our health care system with low coverage for these diseases. As an example, we found that 56% of patients received care at private practices and 23.9% at FUNDEM, leaving only 3.8% for the Ministry of Health, 13.2% for Social Security and 2.5% for the Welfare Board.

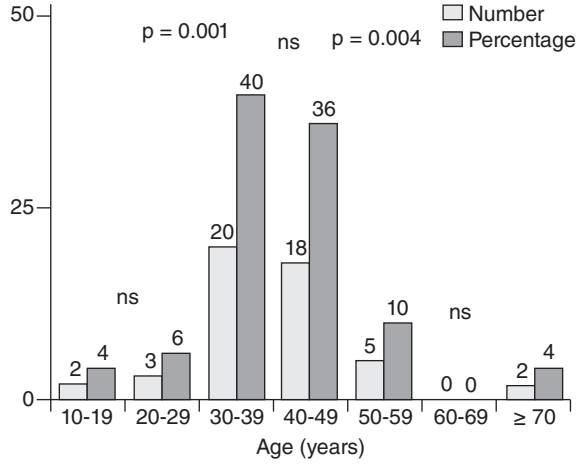

Figure 2 Distribution of cases in the city of Guayaquil, by age group.

In terms of population characteristics related to individual variables (gender, age) and disease variables (evolution time, clinical form), the data are similar to those obtained in other Latin American countries.

Our results indicate that, judging by its two main cities, Ecuador is a low-risk area for MS, contrary to the situation in Europe, USA, Canada, New Zealand and certain parts of Australia. However, several reports point to an increasing prevalence in Latin America[2,6-10,21] (table 5).

In women the disease occurs primarily as other immune disorders, with an onset of clinical signs between 15 and 50 years of age. In our country the distribution by age and gender follows the same epidemiological pattern reported in other latitudes.[11,21]

Ecuador is a country with great ethnic diversity and major geographical features. There are three different regions: the Sierra or Andean region, the Pacific Coast and the East or Amazon. Marked racial and cultural differences can be seen in these regions, and the prevalence rates also differ from one region to another. The prevalence in Quito, an Andean city, is 3 times more frequent than in Guayaquil, the largest city in the country, which is located on the Pacific coast. This indicates a latitudinal gradient with different environmental effects even though both regions were settled largely by Spanish immigrants.

There is no doubt that the risk of MS is determined by genes; however, exogenous environmental factors define important geographical differences.[12,13] Several epidemiological

studies have identified external factors that may be associated with MS.[14]

An inverse correlation between exposure to sunlight and MS prevalence was reported for the first time in 1960.[15] In a given geographical area, such as Tasmania, elevated sun exposure between 6 and 15 years of age was associated with a lower risk of MS.[16] The relationship between solar radiation and lower risk of MS was also shown in Switzerland, based on an inverse correlation to altitude, which is also a marker of higher sunlight intensity.[17] In Ecuador, a country located in the Andes Mountains and on the equator at latitude 0-0, where sun exposure is higher,[19] it is assumed that the prevalence of MS should be lower.

The exact aetiology and pathogenesis of MS in Ecuador still remain unknown. We propose the following hypotheses: *a*) MS occurs as a result of various concomitant factors; *b*) there is no doubt that a strong influence of the human leukocyte antigen (HLA) was received through the process of conquest and colonisation by the Spanish, early in the fifteenth century; *c*) some reports also indicate that early exposure to bacterial and viral infections such as pneumonia and enteritis is still prevalent in genetically susceptible Ecuadorian children;[18] and *d*) that exposure to sunlight in Ecuador is elevated,[19,20] confirming the observation that the greater the luminosity, the lower the risk of MS.

It is important to define a more appropriate methodology to determine MS prevalence in Ecuador that is based on the role of non-profit organisations such as FUNDEM. We believe that before this information is obtained, we should develop a training strategy in diagnosis and early referral of these patients, thus establishing a base network. This would then help to shape our surveillance system for MS.

Conclusions

Ecuador is a low-risk area for MS. Given that this was a hospital-based study with important limitations (such as the fact that there was only partial access to few neurologists, with information recorded exclusively at their private and state offices, and that some centres even refused to submit their medical records and, consequently, to participate in the study), it is clear that the number of patients with MS was underestimated.

Prevalence was higher in women, especially in the third and fourth decade of life, which coincides with the majority of communications in Latin American literature.

It seems important to find a positive correlation with the fact that a higher exposure to sunlight involves a reduced risk of developing MS. On the other hand, we think that the lower incidence in the Ecuadorian coast points to an altitudinal gradient that should be studied in future works; however, the record of the patients in Guayaquil might have been even more incomplete than in Quito, where the presence of FUNDEM made a better study of clinical records possible. We believe in the need for prevalence studies in other areas of the country, including those in which the disease is rare or nonexistent. We were able to identify a lack of accountability in the public health sector regarding the management and care of patients with MS. We recommend the creation of a surveillance and registry system for patients, which will make it possible to obtain better data for an epidemiological analysis.

Conflict of interests

The authors declare no conflict of interests.

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