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Internationally adopted children: What vaccines should they receive?

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ABSTRACT

It is of paramount importance to know the vaccination status in internationally adopted children, so that they can be correctly immunized. This study ascertains the seroprotection rate for vaccine-preventable diseases and the validity of the immunization cards in 637 adopted children. The absence of the immunization card (13% of children) correlated with a poor global vaccine protection. Children with immunization records (87%) had a better global seroprotection but the information obtained from the card did not accurately predict seroprotection for each particular antigen. The best variable to predict the status of seroprotection was the country of origin. The highest rate of protection was found in children from Eastern Europe and, in descending order, India, Latin America, China and Africa. General recommendations for immunization of internationally adopted children are difficult to establish. Actions for vaccination have to be mainly implemented on the basis of the existence of the immunization card and of the country of origin.

1. Introduction

During the last decade the number of internationally adopted children has been continuously increasing [1,2]. According to the data of the Spanish Department of Social Services, more than 30,000 foreign children have been adopted in Spain over the last 10 years making Spain the second country in absolute numbers of international adoptions, only preceded by the USA. Information on these children is limited and it is difficult to ascertain their medical problems [3,4]. In their initial assessment, one of the main concerns is their immunization status. A significant number of adopted children arrive with vaccination documents [2–6], and a major issue is to determine whether they have developed adequate protection against the diseases for which they have supposedly been vaccinated. There have been few published studies about the immunization status of internationally adopted children [7–12], and it is difficult to generalize about the results, mainly because of the low number of children from each of the different countries. Moreover, the lack of common criteria for assessing the validity of vaccine documentation, differences in laboratory techniques and the cut-off values used to evaluate serological immune response, have further contributed to confound and complicate the situation. Because of the absence of predictive factors for immune vaccine protection, the common final conclusion in all these reports has emphasized the advisability of performing serological studies of vaccine protection for all internationally adopted children in order to ensure proper immunization, at least until there are more exhaustive studies.

In relation to vaccination documents, the American Academy of Paediatrics (AAP) [13] has established the essential conditions for considering these records as valid, and previous articles report variable percentages of valid documentation according to these criteria [12,14–16], even taking into account the differences between the validity and the adequacy of the records.

The main objective of this study was to determine the rate of serological protection against immune-preventable diseases (poliovirus 1, 2, 3, tetanus, diphtheria, measles, mumps, rubella and hepatitis B) for a large number of internationally adopted children. The second objective was to relate the results to independent variables: country of origin, age, type and timing of previous setting, type of vaccine and vaccination data referred to in the vaccine documentation. The clinical, nutritional and immunological statuses

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were also studied for all of the children to verify their possible interference with vaccine protection.

2. Patients and methods

This is a cross-sectional study of children carried out from April 2002 to December 2005. *Setting*: The International Adoption Clinic at the Carlos III Hospital in Madrid (Spain), a National Reference Clinic for the evaluation of adopted children. In this centre, a free health assessment is carried out in adopted children who are voluntarily taken there by their adoptive parents, such as it is recommended by the Collaborator Agencies for International Adoption in Spain. Adopted children who had received any doses of vaccine after arriving in Spain and before their first attendance at our clinic were not included in the study. Informed consent to participate in the study was requested from the parents and the protocol was approved by the Hospital's Committee of Ethics.

Demographic data were collected for all of the children, including country of origin, date of birth, age at adoption and at first medical evaluation, the setting where the child lived before adoption and the period of time of institutionalization. For methodological reasons, and according to the internal concordance of the data, we grouped the origin of the children as follows: China, India, Nepal, Eastern Europe, Latin-America (excluding Haiti), Haiti, Africa (excluding Ethiopia), and Ethiopia. Data from preadoptive immunization records were also collected: the type and number of vaccine doses received, date of administration, interval among doses, general characteristics of the records and if the number of doses was up-to-date for age. Definitions of "doses updated according to the age" were the following: children from 6 months to 12 months: 3 doses of each DTP, OPV and hepatitis B; children from 12 months to 24 months: 4 doses of each DTP and OPV, 3 doses of hepatitis B, and 1 dose of MMR; children older than 24 months: 5 doses of DTP, 4 doses of OPV, 3 doses of hepatitis B, 2 doses of MMR. According to the criteria set by the AAP [13] and confirmed by the Advisory Committee on Immunization Practice (ACIP) [17] to assess the validity of vaccine documentation, a vaccine record was considered valid when it included the type of vaccine and date of administration, with the signature or seal of the vaccine provider; all of the records which did not meet these standards were considered as non-valid.

Routine evaluation of the children included a complete medical history, a physical examination and a nutritional index (McLaren's index [18]). Laboratory testing for all of the children followed the usually recommended guidelines [2,4,6,13,19], including tests for HIV, hepatitis B (HB), hepatitis C, tuberculin skin test, intestinal parasites. Immunological status was evaluated by means of immunoglobulins and CD4 lymphocyte subsets. Tests were performed by standard methods in the laboratory of the Hospital.

Specifically for this study, all the samples were tested for vaccine-preventable diseases: antibodies for poliovirus 1, 2, 3, IgG for measles, mumps and rubella viruses, as well as for diphtheria and tetanus toxoids, and HB surface antibody (HBs-Ab). The time elapsed since the children arrived in Spain until they were serologically tested was 16 days [$CI_{95\%}$ 14.34–17.75] (S.D. 21.9 days). The assay for polioviruses was an in-house neutralization assay, using as antigen 100 TCD50 (50% tissue culture infectious dose) of each one of the virus and Hep2 Cincinnati strain. This assay has been validated in a National Seroprevalence Survey carried out in Spanish population [20]. The assays for diphtheria and tetanus toxoids specific IgG were enzyme immunoassay (ELISA) from commercial source (Virion-Serion, Germany); samples were tested diluted 1:100. Measurement of IgG for measles, mumps and rubella viruses was performed by indirect enzyme-linked immunoabsorbent assay (ELISA) from commercial source (Enzygnost-Siemens, Germany); samples were tested diluted 1:231, as recommended by the manufacturer. The detection of HBs-Ab was made by ELISA (Abbot-Axsym). According to the international criteria [21–24], the following titres of antibodies were considered to be protective: poliovirus 1, 2 and 3: 1:2; IgG antibodies for diphtheria: >0.1 IU/mL; IgG antibodies for tetanus: >0.1 IU/mL; IgG antibodies for measles: >150 mIU/mL; IgG antibodies for mumps >1:231; IgG antibodies for rubella >4 IU/mL; hepatitis B surface antigen >10 IU/L.

3. Statistical analysis

The dependent variable was the existence of serological protective titres. We performed univariate and multivariate ($\log R$) analysis with SPSS 13.0. Statistical significance was assumed for values of $p < 0.05$. Bivariate analysis was tested using Pearson's χ^2 or Fisher's exact tests or Student's *T*-test. Kappa statistics was used to assess the agreement between card information, antigen by antigen, and serologic results. Unconditional logistic regression analysis was used in order to include diverse co-variables associated with the dependent variable, thus making the autocorrelation more accurate and controlling any possibly confounding factors. A significance level of $p < 0.20$ was considered to include and exclude variables in the final multivariate model [25].

Serological protective titres were studied in the whole population of children, and in populations stratified for age (children younger than 12 months and children 12 months or older).

4. Results

4.1. Demographic characteristics

A total of 637 internationally adopted children were studied, 76% females [$CI_{95\%}$ 72.8–79.5]. The mean age at adoption was 27.52 months [$CI_{95\%}$ 25.65–29.38], with a range of 5–142 months; 240 children (37.7%) were younger than 15 months of age. Except for children from China, who had a median age of 14.09 months (S.D. ±4.63 months), the age of the children was not significantly different according to the country of origin. The origin and main characteristics of the children are shown in Table 1. The most frequent countries of origin were China (46%), followed by India (21%) and Russia (11%). Most of the children, 89% [$CI_{95\%}$ 86.7–91.6], had been in orphanages before adoption. The mean age at institutionalization was 8 months [$CI_{95\%}$ 6.68–9.40], ranging from 0 to 106 months. The mean time of setting in an institution was 19.48 months [$CI_{95\%}$ 18.36–20.59], with a range of 1–140 months.

4.2. Immunization records

In accordance with the standards of AAP [13] and ACIP [17], 466 records (73.2%) [$CI_{95\%}$ 69.5–76.6] were considered valid, 86 (13.5%) [$CI_{95\%}$ 10.9–16.4] non-valid and 85 children (13.3%) [$CI_{95\%}$ 10.8–16.2] had no vaccine documentation. These figures varied depending on the areas of origin (Table 2). In most of the children (80 out of 86) with non-valid records, the reason for non-validity was the absence of signature or seal of the vaccine provider.

According to the preadoptive immunization records, the number of children updated with OPV (oral poliovirus vaccine) was 511 (80.2%) [$CI_{95\%}$ 76.9–83.2], for DTP (diphtheria–tetanus–pertussis) 510 (80%) [$CI_{95\%}$ 76.7–83.1], for HB 429 (67.4%) [$CI_{95\%}$ 63.6–70.9], monovalent for measles 327 (51.3%) [$CI_{95\%}$ 47.4–55.3], for MMR (measles–mumps–rubella) 116 (18.2%) [$CI_{95\%}$ 15.3–21.4], and for