Hookworm infection and anemia in adult women in rural Chiapas, Mexico

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Abstract
Objective. To describe associations between anemia and hookworm (Necator americanus) infection in hospitalized women in rural Chiapas, Mexico. Material and Methods. We retrospectively reviewed the hospital records of 68 anemic women (defined as having a hemoglobin level <10mg/dl) or with intestinal parasitism, identified through hospital discharge and transfusion records for the calendar year 1999. The medical charts of 86 cases were located, 18 of which were not confirmed as anemia cases. The hospital is located in Altamirano, Chiapas. Characteristics of subjects were compared using Student's t-test (for continuous variables) and the χ² test (for categorical variables). A p-value ≤0.01 was used for statistical significance. Chart review and data analysis took place during the year 2000. Results. Fifty percent of women who had stool examinations were infected with N. americanus. Necator often coexisted with other potential causes of anemia, such as pregnancy and hemorrhage. Hemoglobin levels in hookworm-infected women (mean 4.1 g/dl) were significantly lower than in uninfected women (mean 7.0 gm/dl), and Necator prevalence was significantly higher in the anemic women (50%) than in the overall hospital population (1.9%). Conclusions. Anemic women should be offered stool testing where Necator is present, and should be considered for antihelminthic treatment even if pregnant. Further inves-
Severe iron-deficiency anemia is thought to be associated with a greater than threefold elevation in the risk of maternal mortality, and is also highly associated with maternal and fetal morbidity.\textsuperscript{1,2} It is commonly multifactorial. Local prevalence of risk factors for iron deficiency and anemia may vary broadly between populations. For example, where falciparum malaria infection or the acquired immunodeficiency syndrome are common, they are important contributors to anemia in women of reproductive age.\textsuperscript{3,4} Hookworm infection, whose prevalence also varies by geographic region, may also serve as an important cause of iron deficiency in women of reproductive age.\textsuperscript{5} Greater parasite burdens have been associated with poorer maternal iron status and reduced fetal growth.\textsuperscript{6} Although hookworm is believed to be uncommon in the general Mexican population,\textsuperscript{7} specific population subgroups may still be at high risk. Prompted by a cluster of cases of severe anemia associated with \textit{Necator americanus} infection in adult women in a hospital serving the rural, indigenous poor in Chiapas, Mexico, we investigated the prevalence of hookworm in anemic women admitted to that facility. The study hospital is located in the Selva administrative region of Chiapas, and its patient population was predominantly derived from the Selva and Altos regions.

**Material and Methods**

This was a retrospective review of hospital records. The study protocol was approved by the medical staff and administration of the study hospital. We searched year 1999 logs of patient discharges and blood transfusions for patients who satisfied the following criteria: Female, age > 14 years, and discharge diagnosis of anemia or intestinal parasites. We also searched the transfusion log for female patients > 14 years of age regardless of diagnosis, and examined the hospital laboratory log for the month of June, 1999, the approximate midpoint of the study year. Characteristics of subjects were compared using Student’s t-test (for continuous variables) and the $\chi^2$ test (for categorical variables). Chart review and data analysis took place during the year 2000.

**Results**

One hundred patients satisfied our inclusion criteria. Fourteen medical records were unavailable for review, and 18 did not confirm the diagnosis of anemia (defined as hemoglobin <10 g/dl). Of the remaining 68 patients, 36 (53\%) had one or more stool examinations performed for ova and parasites. Of these, 18 (50\%) revealed \textit{Necator americanus}; a significantly (p<0.001) higher prevalence than the 1.9\% (8 of 417) prevalence detected in the overall hospital patient population in the one-month sample. Other results of the review are presented in the table I.

The presence of another likely cause for anemia—such as post-partum bleeding or gastrointestinal hemorrhage—did not exclude infection with hookworm. However, presence of another likely cause of anemia was associated with a smaller likelihood that ova and parasite examination would be performed: 25\% of anemic women with current or recent pregnancy underwent stool examination, compared to 63\% of anemic women without such a history.

**Conclusiones**

Aunque la prevalencia de infección con \textit{N. americanus} no se considera alta en la población general mexicana, fue importante en las mujeres anémas que se sometieron a coproscopia en nuestro estudio. Las mujeres anémas americanas coproscopia donde existe \textit{N. americanus}, y pueden requerir tratamiento, aunque estén embarazadas. El tema de la asociación de anemia y la población femenina e infección con \textit{N. americanus} merece más investigación en Chiapas, y posiblemente en otros estados de México. El texto completo en inglés de este artículo también está disponible en: http://www.insp.mx/salud/index.html

Palabras clave: anemia; \textit{Necator americanus}; salud materno infantil; México
Discussion

Although we believe that the existence of 18 cases of hookworm-associated severe anemia in adult women admitted to a single rural medical facility during a single calendar year is noteworthy, the generalizability of our findings is limited by the study’s small sample size and retrospective approach. Further investigation, with prospective identification of anemic women and systematic diagnosis of *N. americanus* and other potential contributors to iron deficiency, would be helpful.

Hookworm infestation can be associated with clinically important blood loss, consistent with our finding of significantly lower hemoglobins and a trend toward greater transfusion requirements in our hookworm-infected subjects. Some authorities have suggested that all women of childbearing age, including pregnant women in the 2nd and 3rd trimesters, could benefit from periodic antihelminthic treatment in areas endemic for hookworm, much as presumptive therapy for malaria infection is advised during late pregnancy in malarious regions.8,9 Mebendazole therapy has not been found to be hazardous to mother or infant after completion of the first trimester of pregnancy.10

Health professionals should consider hookworm as a possible cause of anemia in endemic areas regardless of the presence of pregnancy, bleeding, malignancy, or other infectious diseases associated with anemia (such as malaria, typhoid fever, and AIDS). Pregnancy is no longer considered an absolute contraindication to treatment when hookworm infestation is diagnosed, and deferral of treatment may be hazardous to both mother and infant.

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References