Non-occupational exposure to pesticides and childhood acute leukaemia

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Summary

The present study, which included 280 cases of acute leukaemia and 288 controls, investigated the relationship between childhood acute leukaemia (AL) and non-occupational exposure to pesticide during pregnancy and childhood. Acute leukaemia was associated to home insecticide use during pregnancy and during childhood (OR=1.8 [1.2-2.8], OR=1.7 [1.1-2.4], respectively) and garden insecticide use during childhood (OR=2.1 [1.1-4.0]). The association was more pronounced when garden insecticide was used during both pregnancy and childhood (OR=2.9 [1.1-7.3]). Lice infestation of the index child was also associated with AL with an OR of 1.6 (Confidence Interval (CI)=1.0-2.6). Shampoos against lice infestation were associated with childhood leukaemia for pyrethrine shampoos (OR=2.1 [1.2-3.7]) while other shampoos were not associated (OR=1.1 [0.5-2.8]).

Introduction

Leukaemia is the most common cancer in childhood worldwide and, with the exception of ionizing radiation and certain genetic syndromes, its etiology remains unknown. Some previous studies (Lowengart et al. 1987, Buckley et al. 1989, Leiss and Savitz 1995, Meinert et al. 1996, Infante-Rivard et al. 1999, Ma et al. 2002) and two reviews of epidemiologic studies (Daniels et al. 1997, Zahm and Ward 1998) have suggested that residential pesticide exposure might be associated with childhood leukaemia, but results were inconsistent depending on subtypes of cases included, definition of exposure and period of exposure. Some others did not find any association (van Steensel-Moll et al. 1985, Infante-Rivard et al. 1991, Schwartzbaum et al. 1991). Nevertheless, residential pesticide exposure has also been associated to other childhood cancers (lymphomas, brain tumors, neuroblastoma, Wilm’s tumor and Ewing’s sarcoma).

The present study was designed to assess the role of environmental and genetic factors in the etiology of childhood acute leukaemia. We report here results of the analysis of non-occupational exposure to pesticides and childhood acute leukaemia.

Materials and Methods

Cases and controls

Cases were children under the age of 15 years hospitalized for recent diagnosis (< 3 months) of primary leukaemia between 1995 and 1999 in the hospitals of Lille, Lyon, Nancy and Paris (France). Controls were children hospitalized in the same hospital as the cases, mainly in orthopedic and emergency departments. The recruitment was frequency-matched by age, gender, hospital, and ethnic origin. A total of 280 incident cases of acute leukaemia and 288 controls were included in the study.

Data collection

The mothers of the cases and controls were face-to-face interviewed using a standard questionnaire including questions on parents’ socio-demographic characteristics, the child’s
perinatal characteristics and medical history, the familial history of cancer and auto-immune disease, and parents’ occupations and habits. Questions related to pesticide exposure covered periods during pregnancy and from birth to diagnosis, and included home insecticides use and garden pesticides use (insecticides, herbicides and fungicides) by the mother. We also collected data on direct pesticide exposure for the index child with questions on lice infestation and treatments against lice during childhood.

**Study Power**

With a power of 80% and \(\alpha=5\%\), the size of the study enabled to detect minimum odds ratios of 1.4, 1.5 and 1.7 for exposure prevalences among controls of 50%, 20% and 10%, respectively.

**Statistical analysis**

Odds ratios (OR) were estimated using unconditional logistic regression models including stratification variables. Potential confoundings by sociodemographic characteristics, place of residence and type of housing were also considered in the various analyses.

**Results**

Out of the 280 cases included in the study, Acute Lymphoblastic Leukaemia (ALL) was diagnosed in 240 and Acute Non-Lymphoblastic Leukaemia (ANLL) in 40 cases. Good comparability of maternal and paternal schooling was obtained after adjustment for stratification variables. The case and control groups had the same proportion of active mothers, and similar socio-professional category distributions.

A relationship between home and garden insecticide use and childhood leukaemia was observed (Table 1). Childhood acute leukaemia was associated to home insecticide use during pregnancy and during childhood (OR=1.8 [1.2-2.8], OR=1.7 [1.1-2.4], respectively) and garden insecticide use during childhood (OR=2.1 [1.1-4.0]). The association was more pronounced when garden insecticide was used during both pregnancy and childhood (OR=2.9 [1.1-7.3]). Results were unchanged after adjustment for parents’ socio-professional categories, educational levels, place of residence (urban or rural) or type of housing (apartment or house).

We observed a significant association between lice infestation in childhood and acute leukaemia (Table 2). The association was more pronounced when the child had two or more lice infestations. Shampoos against lice infestation were associated with childhood leukaemia for pyrethrine shampoos (OR=2.1 [1.2-3.7]) while other shampoos where not associated (OR=1.1 [0.5-2.8]).

For both, residential pesticide exposure and lice infestation, results remain stable over age categories and estimations were similar for ALL and ANLL.

**Discussion**

The present study evidenced an association between non-occupational exposure to pesticides and childhood acute leukaemia. This association was observed for home and garden pesticide use, during pregnancy and from birth to diagnosis. We also showed an association with insecticidal shampoos for lice infestation use with pyrethrines.

The case and control mothers were very similar with respect to their education, activity, socio-economic status and place of residence. Thus, control selection is unlikely to explain those associations. In addition, the results were unchanged after additional adjustment for parents’ socio-professional categories, educational levels, place of residence (urban or rural).
or type of housing (apartment or house). The use of standardized questionnaires, and the similar interviewing conditions for case and control mothers, reduced potential differential misclassifications. Nevertheless, a recall bias cannot be strictly ruled out. Information on shampoos against lice may be unreliable but probably in the same way in cases and controls.

Our results are consistent with most of the previous studies. Garden pesticide use during pregnancy was associated to childhood leukaemia in two studies (Lowengart et al. 1987, Meinert et al. 1996), a positive association was found with home insecticide use during pregnancy and childhood in two others studies (Infante-Rivard et al. 1999, Ma et al. 2002). Leiss and Savitz (1995) found an association with pest strips use during pregnancy and childhood, and Buckley et al. (1989) observed an association with direct pesticide exposure of the child. To our knowledge, no studies investigated direct pesticide exposure of the child based on data related to lice infestation and insecticidal shampoos against lice.

In conclusion, the findings of the present study suggest that non-occupational exposure to pesticide may be associated with childhood acute leukaemia.

Acknowledgements

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References


Table 1: Residential Pesticide Exposure and Childhood Leukaemia

<table>
<thead>
<tr>
<th></th>
<th>Pesticide use during pregnancy</th>
<th>Pesticide use during childhood</th>
<th>Pesticide use during pregnancy and during childhood</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ca</td>
<td>Co</td>
<td>OR^a</td>
</tr>
<tr>
<td>Garden Pesticides Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All type</td>
<td>28</td>
<td>10</td>
<td>3.4</td>
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<tr>
<td>Insecticides</td>
<td>8</td>
<td>3</td>
<td>2.2</td>
</tr>
<tr>
<td>Herbicides</td>
<td>0</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Pesticide Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insecticides</td>
<td>92</td>
<td>60</td>
<td>1.8</td>
</tr>
</tbody>
</table>

^a Odds Ratio (OR) were derived from an unconditional logistic model, adjusted for age, gender, hospital, ethnic origin, maternal educational level and parental socio-professional category.

^b 95% CI: 95% Confidence interval

Table 2: Lice infestation and Childhood Leukaemia

<table>
<thead>
<tr>
<th>Lice infestation</th>
<th>Ca (n=280)</th>
<th>Co (n=288)</th>
<th>OR^a</th>
<th>95% CI^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>180</td>
<td>195</td>
<td>1.0</td>
<td>reference</td>
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<tr>
<td>Ever</td>
<td>98</td>
<td>90</td>
<td>1.6</td>
<td>[1.0-2.6]</td>
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<tr>
<td>Once</td>
<td>51</td>
<td>48</td>
<td>1.5</td>
<td>[0.9-2.5]</td>
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<tr>
<td>2+</td>
<td>47</td>
<td>42</td>
<td>1.9</td>
<td>[1.1-3.3]</td>
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<tr>
<td>Treatment against lice infestation</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Never</td>
<td>189</td>
<td>216</td>
<td>1.0</td>
<td>reference</td>
</tr>
<tr>
<td>Ever</td>
<td>70</td>
<td>59</td>
<td>1.9</td>
<td>[1.2-3.3]</td>
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<tr>
<td>Pyrethrinines</td>
<td>59</td>
<td>46</td>
<td>2.1</td>
<td>[1.2-3.7]</td>
</tr>
<tr>
<td>Other types (organo-chlorés / organo-phosphorés)</td>
<td>11</td>
<td>13</td>
<td>1.1</td>
<td>[0.5-2.8]</td>
</tr>
</tbody>
</table>

^a Odds Ratio (OR) were derived from an unconditional logistic model, adjusted for age, gender, hospital, ethnic origin, maternal educational level and parental socio-professional category.

^b 95% CI: 95% Confidence interval