High risk of brain tumors in farmers: a mini-review of the literature, and report of the results of a case control study

P. Fallahi1, R. Foddis1, A. Cristaudo1, A. Antonelli2

1 Department of Translational Research and of new Technologies in Medicine and Surgery, University of Pisa, Pisa; 2 Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy

Abstract

Even though a relationship between farmer work and the development of brain tumors was suggest by the scientific literature, a small number of italian studies investigate on the impact of this job on the cancer morbidity of farmer population.

The informations about this case–control study were obtained from patients recruited in the Neurosurgical Department of the University-Hospital of Pisa, Italy, from 1990 to 2000.

One hundred and seventy-four, newly diagnosed cases of brain tumors (glioma and meningiomas, histologically confirmed), were recruited, such as 522 controls (with other non tumoral neurologic diseases: trauma, etc), by matching cases and controls (1:3), for age (± 5 years) and gender.

Cases and controls were interviewed in the Neurosurgical Department, University-Hospital of Pisa, Italy, and the occupational histories of cases and controls were compared.

Cases and controls have showed a statistically significant difference, based on their occupation (agricultural vs. non-agricultural). We observed a significant association among brain tumors and rural activity in evaluated patients (P=0.008).

Further studies regarding this population group are needed, to determine the causes for the increased risk of this cancer, particularly in regions where there is an intense agricultural activity and where pesticides are used. Furthermore, a subsequent reevaluation in other patients collected in more recent years will be needed to evaluate the trend of this association.

Key words: Brain tumors, Farmer work, Occupational exposure

Introduction

Malignant tumors of the nervous system are letal in a significant percentage of cases, with an incidence and mortality increased recently in a large number of countries. For this reason, researchers were motivated in studying the distribution and in finding answers for this increase (1).

An increasing incidence of brain tumors has been reported also in Tuscany (2). There are about 20 types of cancer brain, grouped in: gliomas more frequent in men and meningiomas more diffuse among women (3, 4).

Even though several factors are associated to the development of brain tumors, their pathways need to be clarified (5-7).

Several studies indicate that some specific tumors, brain tumors included, are the cause of the higher risk of death among agricultural workers.

The major hypothesis is that the high percentage of letal cases, is due to the presence of pesticides in the work of the farmers (8-11).

In the United States, (12) was observed that the risk of developing glioma is high among farmers, whose exposition to pesticides was more than twenty-five years [Odds Ratio (OR) 3.9, 95% Confidence Interval (CI) 1.8–8.6].

The risk of letal brain tumors in pesticides exposed cathegory of workers is dramatically increased in India too, reaching levels about ten times higher with respect to workers not exposed (13).

In Brasil too, a similar association was suggested, reporting the exposure to pesticides as a risk factor in agricultural workers (14).

Even though a relationship between farmer work and the development of brain tumors was suggest by the scientific literature, a small number of italian studies investigate on the impact of this job on the cancer morbidity of rural population.

A first study reported that the occupational exposure of farmers to agrochemicals could be a cause for the observed excess risk of brain glioma in farmers (15). However other studies have reported contrasting results (16,17).

Aim of this study is to conduct a case control study to evaluate whether being a farmer is a risk factor for developing brain malignant tumors.

Correspondence: Poupak Fallahi, Department of Clinical and Experimental Medicine, University of Pisa. Via Savi 10, 56126, Pisa, Italy
Phone: +39-050-992318; Fax: +39-050-993472. E-mail: poupak@int.med.unipi.it
Methods

Study design

The informations of this case–control study were obtained in the Neurosurgical Department of the Hospital of Pisa, Italy, from 1990 to 2000.

Study population

During 1990 to 2000, newly diagnosed cases of brain malignant tumors (glioma and meningiomas, histologically confirmed), were recruited, such as controls (with other non tumoral neurologic diseases: trauma, etc), by matching cases and controls (1:3), by age (± 5 years) and gender.

Cases and controls were interviewed in the Neurosurgical Department University of Pisa, Italy, comparing their occupational histories.

The interview was performed before the surgical operation. If histological examination did not confirm the presurgical diagnosis cases were excluded.

In agreement to the 10th revision of International Classification of Diseases and Related Health Problems (ICD-10), the above-mentioned tumors were classified as: malignant neoplasm of cerebral meninges (C70.0), malignant neoplasm of brain (C71.0–C71.9).

Controls, in which the postsurgical histology revealed the presence of secondary malignancy (for example metastases), and individuals whose information relative to the occupation were inconclusive or missing, were excluded.

In that period, 174 newly diagnosed cases of brain malignant tumors (glioma and meningiomas) were recruited, and compared with 522 consecutively recruited controls (with other non tumoral neurologic diseases: trauma, etc), see Table 1.

Study variables

Race (white or non-white), school education (without school education, from one to five, five to ten, eight to eleven, eleven or more years of school education), age (from eighteen to twenty-nine, thirty to thirty-nine, forty to forty-nine, fifty to fifty-nine, sixty to sixty-nine, seventy to seventy-nine years and over eighty years of age) and area of residence are other independent variables that were included in the study.

The use of mobile was not recorded, because until 1995 their use in Italy was sporadic.

Statistical analysis

We have performed a descriptive analysis about independent variables frequency and we have used a chi-square (X2) evaluating differences between cases and controls. The risk was evaluated by the stepwise forward Adjusted OR (aOR) for the variables race, age and residence, by unconditional logistical regression. CI (95%) of OR were evaluated too (by Java stat 2 way contingency Table analysis, and by JMP Software from SAS).

Results

The study population included 174 cases (70 females, mean age 52±15 years; 104 males, mean age 53±17 years) and 522 age and gender matched controls (210 females, mean age 52±16 years; 312 males, mean age 54±16 years). The comparison of cases vs. controls, by age, or gender, show non significant difference p>0.05.

The distribution sites for malignant brain neoplasms were: 97.1% brain, 1.9% cranial nerves and 1.0% cerebral meninges.

Table 2 shows the distribution of cases and controls by different variables. Cases and controls were matched by age (cases, age<50 years 29%; controls, age<50 years, 30%), and race (cases, white 93.1%; controls, 92.5%) with no significant difference in their distribution. Cases and controls showed a statistically significant difference, based on their occupation (agricultural vs. non-agricultural; p=0.008).
Table 3. Odds ratio, for the occupation (agricultural vs. non-agricultural) between cases and controls.

<table>
<thead>
<tr>
<th>Odds Ratio</th>
<th>95% Lower</th>
<th>95% Upper</th>
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<tbody>
<tr>
<td>2.174</td>
<td>1.166</td>
<td>4.039</td>
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Table 3 shows the OR, for the occupation, between cases and controls. A higher risk of brain cancer was estimated among individuals that were engaged in agricultural activities.

Discussion

The relationship between agricultural occupation and brain tumors development is discussed (18).

The results obtained confirm similar findings of other case–control studies, which have shown a higher incidence of brain tumors among farmers, suggesting the exposure to pesticides as the main inducer of these tumors (15, 19-22).

Nevertheless, this association is not been confirmed by other case–control studies (23-25). Also in Italy other studies have reported contrasting results (16,17).

Even though several factors are correlated to the development of brain tumors, the real factors which are implicated in the genesis of these tumors are still unknown.

Several studies indicate that agricultural workers have an increased risk of mortality by cancer, brain tumors included. It has been hypothesized that this increased mortality is correlated to the high exposure to pesticides in farm workers (8-13).

There are some limitations in this study, such as the lack of evaluation of factors like attitude to smoke, consume of alcohol and particular dietary habits, because even if investigated in the apposite questionnaire more than 50% of cases and controls did not respond at this questions, byasing any possible result.

This study has not evaluated the duration of the exposure to pesticides, but only the occupation of subjects as farmers. Furthermore, there has not been evaluated other exposures to environmental factors, which can be present in everyday life.

We observed a significant relationship between brain tumors and agricultural activity in Italy. Further studies regarding this population group are needed, to determine the causes that augment cancers mortality, particularly in regions where there is an intense agricultural activity and pesticides were used.

References