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PESTICIDE EXPOSURE AND ITS RELATION TO MULTIPLE MYELOMA - A HOSPITAL BASED STUDY AT GAUHATI MEDICAL COLLEGE & HOSPITAL, GUWAHATI, ASSAM

Oncology

KEYWORDS: Myeloma, vernerable, pesticides

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ABSTRACT

Findings from different studies evaluating risk of developing multiple myeloma (MM) and exposure to pesticides as a general category, including findings among persons who reported ever using pesticides or among licensed pesticide applicators, have been inconsistent; as some studies reported positive associations while others reported inverse associations. This study aimed to investigate the association between pesticides and developing MM. **Summary :** Prevalence of MM is significantly high ($p>0.00001$) among the farmers working in agriculture as compared to those in farms; Pesticide exposure is relatively high with cultivation of crops than vegetable ($p<0.00001$); among the farmers working in farms, those who work in farm with furred animals are more vernerable ($p<0.00001$) to the prevalence of MM than the others; frequency of pesticide exposure has no effect ($p=0.354$) on the prevalence of MM; prevalence of MM is significantly high ($p=0.0005$) among farmers who expose to pesticides for more than 5 years as compared to those exposing for less time and prevalence of MM is very insignificant ($p<0.00001$) among the fruit and pesticide sellers.

INTRODUCTION

Multiple myeloma (MM) is a malignancy of plasma cells that results in an overproduction of light and heavy chain monoclonal immunoglobulin (Ig). Multiple myeloma is a clonal plasma cell malignancy characterized by the proliferation of neoplastic plasma cells. More importantly, delineation of the mechanisms mediating plasma cell proliferation, survival and migration in the bone marrow microenvironment may enhance the understanding of pathogenesis, and a better understanding of the molecular pathogenesis is fundamental for developing more effective prognostic, therapeutic and preventive approaches.

MATERIALS AND METHODS

This study is based on studies conducted on Pesticide Exposure and its Relation to Multiple Myeloma- a Hospital Based Study at Gauhati Medical College & Hospital, Guwahati, Assam. A total of 100 cases were studied in the Out Patient Department (OPD) of the Clinical Haematology Department, Gauhati Medical College & Hospital, and Guwahati, Assam. Being a descriptive study, the data were procured from the OPD of the same department. **Research type** - Hospital based cross-sectional descriptive study. **Study setting** - the present study has been undertaken in the Out Patient Department of the Clinical Haematology Department of Gauhati Medical College & Hospital, Guwahati, Assam. **Study period** - the study period was three years commencing from November, 2010 to October, 2013. **Study population** - the study population comprise of 100 numbers of newly diagnosed cases of multiple myeloma attending the OPD of the Clinical Haematology Department of Gauhati Medical College & Hospital, Guwahati, Assam during the period of November, 2010 to October, 2013. Before undergoing the study clearance from institutional ethical committee was obtained. Analysis of data was done in the year 2014-15. **The sample** - Sample size of 100 number of newly diagnosed multiple myeloma patients were taken into the study during the period of November, 2010 to October, 2013. **Selection of cases** - We have taken all the newly diagnosed cases of multiple myeloma into the study attending at OPD of the Clinical Haematology Department of Gauhati Medical College & Hospital, Guwahati, Assam during the period of November, 2010 to October, 2013. Initially patients were selected purely on clinical ground and then negative cases were excluded after diagnosis based on International Myeloma Working Group (IMWG) criteria for diagnosis of monoclonal gammopathys. Inclusion criteria - One hundred newly diagnosed cases of multiple myeloma of all age group from November, 2010 to October, 2103. Exclusion criteria – (1) Old diagnosed cases of multiple myeloma that are under treatment. (2) Monoclonal gammopathys of undetermined significance (MGUS) (3) Asymptomatic (smoldering) multiple myeloma. **Protocol** - The proforma was prepared based on universal standard protocols for evaluation of multiple myeloma which contains separate history, examination and investigation parts. The International Myeloma Working Group.(IMWK) criteria for classification of monoclonal gammopathys, multiple myeloma and related disorders were used for diagnosis of the disease. During the study period Immunofixation electrophoresis test (for serum/urine) was not available in the institute. So this test was not included into the study. Then staging was made according to International Staging System (ISS). Performance status of patients was made according to Eastern Co-operative Oncology Group (ECOG) standard performance protocol (Appendix-1). **Methods** –Details of the patient - Details of the patients were recorded in the manner in order of age, sex, religion, caste, occupation, address, hospital number and registration number for identification and documentation. When patients were first examined a detailed history was taken and thorough clinical examination was done. Then they underwent a battery of investigations to confirm diagnosis. All the patient's history, clinical examination, investigation findings, and diagnosis data were recorded in a pre-designed and pre-tested proforma. **Statistical analysis** - data were analysed using statistical package and results and observations were presented in tabular form. Statistical tests were applied wherever required.

RESULT AND OBSERVATIONS

1: Distribution of different forms of pesticides used by the farmers

N=100

Different forms of pesticide used	Males		Females		Total	
	No.s	%	No.s	%	No.s	%
In agriculture	20	29.85	00	00	20	20
In farm	5	7.46	00	00	5	5
Not exposed	42	62.69	33	100	75	75
Total	67	100	33	100	100	100

Table-1: Distribution of different forms of pesticides used by the

farmers

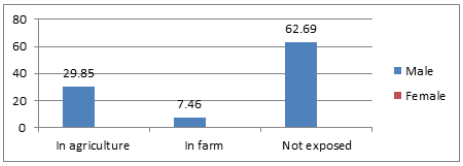


Figure -1: Bar diagram showing distribution of different forms of pesticides used by farmers

The above table-1 shows that 20 (20%) patients were exposed to pesticides in agriculture sector and 5 (5%) patients in farm sector. Seventy five (75%) patients were not exposed to pesticides. The statistical analysis from the table-1 suggest that prevalence of MM is significantly high (p>0.00001) among the farmers working in agriculture as compared to those in farms. (Test statistics: 'Z' test for differences of two proportion, calculated value of 'Z'=0.6.8)

2. Distribution of exposure of farmers to pesticides in different agriculture works **N=100**

Exposure of farmers to pesticides in different agriculture works	Males		Females		Total	
	No.s	%	No.s	%	No.s	%
Crops	15	22.39	0	0	15	15
Vegetables	5	7.46	0	0	5	5
Not exposed	47	70.15	33	100	80	80
Total	67	100	33	100	100	100

Table-2: Distribution of exposure of farmers to pesticides in different agriculture works

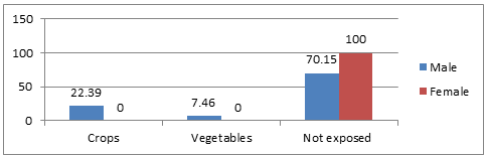


Figure -2: Bar diagram showing distribution of exposure of farmers to pesticides in different agriculture works

The above table-2 shows that during cultivation of crops 15 (15%) patients were exposed to pesticides while 5 (5%) patients were exposed with cultivation of vegetables. Statistical analysis from the table-2 suggest that there is some difference (p<0.00001) in relation to risk of pesticide exposure between cultivation of crops and vegetable. Pesticide exposure is relatively high with cultivation of crops than vegetable.

3. Distribution of different modes of exposure of farmers to pesticides in different farming **N=100**

Different modes of exposure to pesticides in different farming	Males		Females		Total	
	No.s	%	No.s	%	No.s	%
Furred animals	3	2.99	00	00	3	3
Chicken	1	1.49	00	00	1	1
Grain dust	1	1.49	00	00	1	1
Not exposed	62	94.02	33	100	95	95
Total	67	100	33	100	100	100

Table-3: Distribution of different modes of exposure of farmers to pesticides in different farming

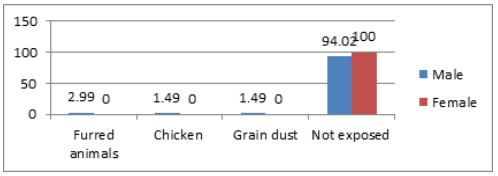


Figure -3: Bar diagram showing distribution different modes of exposure of patients to pesticides in different farming

The above table-3 shows that pesticides exposure occurred in 3 (3%) patients in farm industry having cattle, poultry, sheep and other furred farm animals; 1 (1%) patient in chicken farm and 1 (1%) patient in farm of grain dust. The statistical analysis from the table-3 suggest among the farmers working in farms, those who work in farm with furred animals are more venerable (p<0.00001) to the prevalence of MM than the others. (Test statistics: 'Z' test for differences of two proportion, calculated value of 'Z'=9.2)

4. Distribution of frequency of pesticides exposure to the patients **N=100**

Frequency of pesticides exposure (episodes) in 6 months	Males		Females		Total	
	No.s	%	No.s	%	No.s	%
5 – 10 times	5	7.46	00	00	5	5
11 – 15 times	7	18.92	00	00	7	7
16 – 20 times	8	11.94	00	00	8	8
21 – 25 times	4	5.97	00	00	4	4
No exposed	43	64.17	33	100	76	76
Total	67	100	33	100	100	100

Table-4: Distribution of frequency of pesticides exposure to the patients

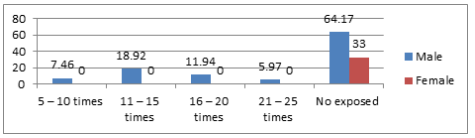


Figure -4: Bar diagram showing distribution of frequency of pesticides exposure to the patients

The above table-4 shows that 8 (8%) patients exposed to pesticides 16-20 times in 6 months, 7 (7%) patients 11-15 times in 6 months, 5 (5%) patients 5-10 times in 6 months and 4 (4%) patients 21-25 times in 6 months.The statistical analysis from the table-4 shows that frequency of pesticide exposure has no effect (p=0.354) on the prevalence of MM. (Test statistics: 'X^{2}' test for independences of attributes, calculated value of 'X^{2}'=3.25)

5. Distribution of duration of pesticides exposure to the patients **N=100**

Duration of pesticides exposure in years	Males		Females		Total	
	No.s	%	No.s	%	No.s	%
1 – 2 years	1	1.49	00	00	1	1
2 – 4 years	2	2.99	00	00	2	2
4 - 5 years	7	10.45	00	00	7	7
>5 years	14	20.90	00	00	14	14
Not exposed	43	64.17	33	100	76	76
Total	67	100	33	100	100	100

Table-5: Distribution of duration of pesticides exposure to the patients

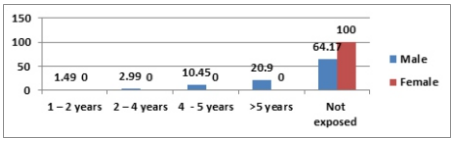


Figure-5: Bar diagram showing distribution duration of pesticides exposure to the patients

The above table-5 shows that 14 (14%) patients were exposed to pesticides for more than 5 years, 7 (7%) patients for 4-5 years, 2 (2%) patients for 2-4 years and 1 (1%) patient for 1-2 years. The statistical analysis shown in the table-5 suggest that prevalence of MM is significantly high (p= 0.0005) among farmers who expose to pesticides for more than 5 years as compared to those exposing for less time. (Test statistics: 'x^{2}' test for independences of attributes, calculated value of 'x^{2}'=17.66)

DISCUSSION

1: Distribution of different forms of pesticides used by the farmers

In our study 20 (20%) patients were exposed to pesticides in agriculture sector and 5 (5%) patients in farm sector. Seventy five (75%) patients were not exposed to pesticides. Statistical analysis

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suggest that prevalence of MM is significantly high (p>0.00001) among the farmers working in agriculture as compared to those in farms. Mannetje A et al. (2005)[1] and Baris D et al. (2004)[2] have demonstrated the risk of the occurrence of myeloma in agricultural workers with use of fuels and pesticides in general.Burmeister L.F.(1983)[3] reported association of MM in farmers working in chicken firm, Pukkala E. and Notkola V (1997)[4] reported in pig or poultry farm and Baris D et al. (2004)[2] reported in sheep farm. Thus, our study findings are consistent with various other studies of Mannetje A et al. (2005) and Baris D et al. (2004), Burmeister L.F.(1983), Pukkala E. and Notkola V (1997) and Baris D et al. (2004). It can be explained that farmers are more exposed to pesticides in agriculture than farming. So, incidences of MM are high among agricultural farmers in relation to farmers working in farms. Moreover, as most of the farmers are male, prevalence of MM is more in male than female. Thus our study results correlated with these international studies.

2: Distribution of exposure of farmers to pesticides in different agriculture works

In the study it has observed that during cultivation crops 15 (15%) patients were exposed to pesticides while 5 (5%) patients were exposed to pesticides with cultivation of vegetables. Statistical analysis suggest that there is some difference (p<0.00001) in relation to risk of pesticide exposure between cultivation of crops and vegetable. Pesticide exposure is relatively high with cultivation of crops than vegetable. It can be explained that farmers are more exposed to pesticides in cultivation of corps than cultivation of vegetables. So, incidences of MM are high among agricultural farmers with cultivation of corps than vegetables.

3: Distribution of different modes of exposure of farmers to pesticides in different farming

It was observed in the present study that pesticides exposure occurred in 3 (3%) patients in farm industry having cattle, poultry, sheep and other furred farm animals; 1 (1%) patient in chicken farm and 1 (1%) patient in farms of grain dust. Statistical analysis suggest that among the farmers working in farms, those who work in farm with furred animals are more vernerable (p<0.00001) to the prevalence of MM than the others. Fritschi L et al(2002)[5] and Baris D et al.(2004)[2] reported nonsignificant relative risk estimates for MM for poultry, cattle, sheep, horse and pig farmers. Heinemann E.F (1992a)[6] and Pottem L.M.(1992a)[7] reported association of MM in farmers who lived with furred animals and firm animals and Burmeister L.F(1983)[3] reported with chicken farm. Our study findings cab be correlated with these studies.

4: Distribution of frequency of pesticides exposure to the patients

In our study 8 (8%) patients were exposed to pesticides 16-20 times in 6 months, 7 (7%) patients exposed 11-15 times in 6 months, 5 (5%) patients exposed 5-10 times in 6 months and 4 (4%) patients exposed 21-25 times in 6 months. Statistical analysis shows that frequency of pesticide exposure has no effect (p=0.354) on the prevalence of MM.

5: Distribution of duration of pesticides exposure to the patients

In the study 14 (14%) patients were exposed to pesticides for more than 5 years, 7 (7%) patients for 4-5 years, 2 (2%) patients for 2-4 years and 1 (1%) patient for 1-2 years. Statistical analysis suggest that prevalence of MM is significantly high (p=0.0005) among farmers who expose to pesticides for more than 5 years as compared to those exposing for less time.

Patients did not give history regarding individual type of pesticides used. So individual type of pesticides could not be studied.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

MAJOR FINDINGS OF THE STUDY

(1)Twenty (20%) patients were exposed to pesticides in agriculture sector and 5 (5%) patients in farm sector. Seventy five (75%) patients were not exposed to pesticides. Statistical analysis suggest that prevalence of multiple myeloma is significantly high (p>0.00001) among the farmers working in agriculture as compared to those in farms.

(2)During cultivation of crops 15 (15%) patients were exposed to pesticides while 5 (5%) patients were exposed with cultivation of vegetables. Statistical analysis suggest that there is some difference (p<0.00001) in relation to risk of pesticide exposure between cultivation of crops and vegetable. Pesticide exposure is relatively high with cultivation of crops than vegetable.

(3)Pesticides exposure occurred in 3 (3%) patients in firm industry having cattle, poultry, sheep and other furred farm animals; 1 (1%) patient in chicken firm and 1 (1%) patient in firms of grain dust. Statistical analysis suggest among the farmers working in farms, those who work in farm with furred animals are more vernerable (p<0.00001) to the prevalence of multiple myeloma than the others.

(4)Eight (8%) patients exposed to pesticides 16-20 times in 6 months, 7 (7%) patients 11-15 times in 6 months, 5 (5%) patients 5-10 times in 6 months and 4 (4%) patients 21-25 times in 6 months. Statistical analysis shows that frequency of pesticide exposure has no effect (p=0.354) on the prevalence of multiple myeloma.

(5)Fourteen (14%) patients were exposed to pesticides for more than 5 years, 7 (7%) patients for 4-5 years, 2 (2%) patients for 2-4 years and 1 (1%) patient for 1-2 years. Statistical analysis suggest that prevalence of multiple myeloma is significantly high (p=0.0005) among farmers who expose to pesticides for more than 5 years as compared to those exposing for less time.

(6)One (1%) patient was fruit seller and 1 (1%) pesticides seller. Statistical analysis suggest prevalence of multiple myeloma is very insignificant (p<0.00001) among the fruit and pesticide sellers.

RECOMMENDATIONS OF THE STUDY

(1) Some screening tests like detection of pesticide exposure should be held periodically by the health agencies to detect the disease early specially in elderly people who are at risk of having environmental, occupational and life style factors for development of multiple myeloma. For this hospital should be well equipped with uninterrupted supply of materials necessity for early detection of multiple myeloma. Health agencies should be encouraged to organize periodic camps, health mela for screening of the disease.

(2)Environmental, occupational and life style factors which are risk for development of multiple myeloma should be included into the health education programmers so that the disease can be prevented. Information, Education and Communication (IEC) activities should be strengthened to disseminate these informations to the people. Moreover, periodical orientation course to medical and paramedical staff should be undertaken.

(3)The study was a descriptive study. So any conclusions drawn will have to be guarded and will have to confirm with further trials in India.

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