

Environmental Exposures in Elderly Canadians With Parkinson's Disease

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ABSTRACT: Background: Etiologic hypotheses for Parkinson's disease have implicated environmental factors, genetic factors, or a combination of the two. **Methods:** Data from a survey of elderly Canadians ($n = 10,263$) with regard to their history of Parkinson's disease and previous environmental exposures were analyzed. Exposure to various environmental factors was compared between 87 patients with Parkinson's disease and 2070 elderly controls without Parkinson's disease. **Results:** Exposure to plastic resins (OR (odds ratio) = 8.79), epoxy resins (OR = 6.94), glues (OR = 4.26), paints (OR = 3.84), and petroleum (OR = 2.30) products was significantly ($p < 0.05$) associated with Parkinson's disease. **Conclusion:** These substances deserve further exploration with respect to the possible development of parkinsonism.

RÉSUMÉ: Expositions environnementales chez des Canadiens âgés souffrant de la maladie de Parkinson. Introduction: Des facteurs environnementaux, des facteurs génétiques ou une combinaison des deux ont été proposés comme hypothèse étiologique de la maladie de Parkinson. **Méthodes:** Nous avons analysé les données d'une étude de Canadiens âgés ($n = 10,263$) quant à une histoire personnelle de maladie de Parkinson et aux expositions environnementales. L'exposition à différents facteurs environnementaux de 87 patients parkinsoniens a été comparée à celle de 2070 contrôles âgés non parkinsoniens. **Résultats:** Une exposition à des résines de plastique (risque relatif (RR) = 8.79), à des résines d'époxy (RR = 6.94), à des colles (RR = 4.26), à des peintures (RR = 3.84) ou à des produits pétroliers (RR = 2.30) était associée de façon significative ($p < 0.05$) à la maladie de Parkinson. **Conclusions:** Ces substances méritent qu'on explore davantage la possibilité qu'elles soient reliées au développement de la maladie de Parkinson.

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The etiology of Parkinson's disease is unknown. Theories of pathogenesis have included environmental, genetic, and more recently, biochemical factors, such as a mitochondrial defect.¹ The capacity of MPTP to cause parkinsonism has led to a search for exogenous factors playing a role in the production of Parkinson's disease. In the search for specific environmental factors linked with disease development, some investigators have focused on rural living (including pesticide and well water exposure) as a contributor.^{2,3} We report results of a survey of elderly Canadians with regard to substance exposure and subsequent development of Parkinson's disease.

METHODS AND MATERIALS

The Canadian Study of Health and Aging was a large, random, survey of 10,263 Canadians 65 years and above, from both community and institutional settings in all provinces, over a period from 1991-1992.⁴ The primary aim of the study was to examine health problems in the elderly, especially the prevalence of and risk factors for various types of dementia. As part of the elucidation of risk factors, patients or their caregivers, and normal controls, were questioned regarding past exposure to various exogenous substances, either via their occupations or hobbies. The exposures were of a semi-quantitative nature (positive only if frequently used). Subjects and their caregivers also provided a detailed medical history, including a diagnosis of Parkinson's disease. To determine if

the relationships reported in the literature between parkinsonism and these exposures, especially rural factors, such as pesticides, were present, we compared elderly people with and without a history of Parkinson's disease. Odds ratios (with 95% confidence intervals) were calculated.⁵

RESULTS

Of 29 substances which were listed in the risk factor questionnaire, an association with a history of Parkinson's disease was found for plastic resins, epoxy resins, plastic cement/glues, aerosol/spray paints, and fuels/gasoline/petroleum (in decreasing order of significance). The full list of substances and the respective odds ratios can be found in the Table.

DISCUSSION

This epidemiologic survey has the limitations inherent in any study of its kind, in particular, recall bias and proxy report of

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Table: Exposure to Various Environmental Factors – a Comparison of Elderly With and Without Parkinson's Disease.

Variable	Patients with Parkinson's disease (N = 87) % exposed	Subjects without Parkinson's disease N = 2070 % exposed	Odds Ratio	(95% Confidence Interval)
Occupational Exposure:				
Inks or dyes	18.0	13.5	1.40	(0.65, 2.79)
Paints, stains, varnishes	26.2	20.8	1.35	(0.70, 2.48)
Gasoline, fuels, oils	26.2	23.6	1.15	(0.60, 2.11)
Solvents (degreasers)	24.2	19.6	1.31	(0.67, 2.42)
Liquid plastics or rubbers	5.3	5.5	0.95	+
Glues or adhesives	10.5	14.8	0.68	+
Pesticides, fertilizers	25.0	15.6	1.81	(0.92, 3.36)
Defoliant, fumigants	5.4	3.9	1.40	+
Radiation	1.9	1.5	1.25	+
Excessive noise	31.7	26.2	1.30	(0.71, 2.33)
Vibratory tools	13.6	15.1	0.88	(0.36, 1.90)
Film developing fluids	1.9	1.7	1.09	(0.01, 96.68)
Hobbies and Sports:				
Gardening	62.3	54.2	1.42	(0.86, 2.37)
Home, furniture repairs, restoration	12.1	11.0	1.11	(0.42, 2.49)
Painting	15.6	9.0	1.89	(0.84, 3.85)
Car or motorcycle maintenance	11.9	6.3	1.96	(0.73, 4.47)
Contact sports (boxing etc.)	5.3	2.7	2.03	+
Camping	6.5	7.1	0.91	+
Boating	8.3	7.8	1.07	(0.33, 2.73)
Chemical solvents – turpentine	14.1	9.0	1.66	(0.70, 3.47)
Paint remover, degreasing agent, etc.	13.1	7.4	1.88	(0.75, 4.11)
Paints, stains or lacquers	12.3	9.9	1.28	(0.52, 2.76)
Aerosol, spray paints	11.9	3.3	*3.89	(1.42, 9.18)
Dyes	3.6	1.7	2.12	(0.24, 8.82)
Pesticides or herbicides	13.6	8.6	1.67	(0.67, 3.63)
Plastic cement, glues	15.5	4.1	*4.26	(1.76, 9.26)
Plastic resins	9.8	1.2	*8.79	(2.43, 25.89)
Epoxy resins	11.1	1.8	*6.94	(2.23, 18.28)
Fuels, gasoline or petroleum	21.7	10.7	*2.30	(1.12, 4.43)

+ One or more cells with less than 5 observations

* Odds ratio significantly different from 1 ($p < 0.05$)

exposure information. The fact that Parkinson's disease was not the primary study endpoint may diminish the former problem.

There was incomplete reporting of some data elements. However, in general, the subjects with a history of Parkinson's disease had a somewhat higher proportion of missing exposure data than those without such history. This would tend to produce conservative estimates of association between parkinsonism and the exposures in question. Since subjects were randomly selected from community and institutional settings, case selection bias is also reduced.

Given the relatively large number of comparisons made, it is likely that some of the associations detected could be due to chance alone. Nevertheless, the correlation between a history of Parkinson's disease and resin exposure is a hypothesis for further exploration, since an association between chemical compounds and parkinsonism has been suggested elsewhere.⁶ Additional studies would have to be done to further investigate this possible relationship.

In addition to MPTP and pesticides, case reports have identified n-hexane, methanol, lacquer thinner abuse, and ingestion

of petroleum wastes as possible precipitants for the expression of parkinsonian symptoms.⁷⁻¹⁰ Further study of the chemical composition of resins is warranted to see if there is a plausible biological link between exposure and extrapyramidal motor dysfunction.

Identifying a common chemical denominator among this group of substances may prove to be difficult since resins are typically a composite of ten to 40 elements. However, these substances have in common a solvent base. Therefore, although the etiology of Parkinson's disease is most likely multifactorial, those environmental factors which can be identified and possibly eliminated should be pursued.

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