

CLINICAL STUDY

Spectrum of movement disorders in professional welders

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Abstract: *Objective:* To examine the clinical presentation of movement disorder in patients who reported a history of welding.

Methods: A retrospective chart review during a three-year period was performed on all movement disorders and patients who had been welders were identified. The clinical presentation of these patients was categorized by the movement disorder at the time of the initial neurological evaluation and by the therapy response. A comparison group was created by randomly selecting four non-welders for each welder.

Results: Among 1126 charts reviewed, eleven patients presented with a welder history. Parkinsonism was a common presentation in both groups: three of the eleven welders (27 %) and five of the forty-one controls (12 %). Dystonia was also common with 27 % and 20 %, respectively. Using the chi-squared analysis, the prevalence rates for both parkinsonism and dystonia were similar to controls. All of the welder patients with parkinsonism responded to dopaminomimetic therapy. Six of the eleven welders had elevated manganese levels in either blood or urine.

Conclusions: Welders who present with a movement disorder such as parkinsonism or dystonia, have the prevalence rates for these disorders similar to the non-welder population (*Fig. 2, Ref. 15*). Full Text (Free, PDF) www.bmj.sk.

Key words: movement disorders, professional welders, parkinsonism, dystonia.

Manganese intoxication is known to cause parkinsonism in acute exposures (1, 2). Chronic exposure, which is thought to occur in welding due to manganese being a component of several welding materials has not been shown to be associated with higher rates of parkinsonism or other movement disorders (3, 4, 5). Manganese can be toxic to neurons through several mechanisms.

In experimental models, manganese is concentrated in the basal ganglia and decreases peroxidase and catalase. Mitochondrial function is impaired via interference with F1-ATPase and complex I. Manganese may also promote the release or activity of calcium ions and activate N-methyl-D-aspartate (NMDA) receptors, leading to apoptosis (6). Manganese also competes with iron for transport across the blood-brain barrier and may affect the actions of this metal (7).

Previous investigations in manganese miners have reported that toxicity of this metal produces a clinical syndrome of emotional instability (“manganic madness”), muscular weakness, dysarthria, rigidity, decreased facial expression, and headache (8). Several movement disorders, including parkinsonism, dystonia, tremor and myoclonus have been also associated with manganese toxicity or welding (1, 8–14). However, outside of manganese miners, who likely experience extremely high levels of chronic exposure, there has been little systematic analysis of the effect of manganese exposure on movement disorders. Thus, the

prevalence of other movement disorders related to welding is not known. In this study we evaluated the initial presentation of the movement disorder the welders at our clinic and compared the findings to a random sample of non-welder patients. Where available, blood or urine manganese levels were reported, as a marker for manganese exposure (10).

Methods

In order to evaluate the spectrum of manganese-associated movement disorders, a retrospective chart review was conducted in all patients over a three-year period. The protocol for this chart review was reviewed and approved by the Vanderbilt Institutional Review Board.

All subjects were patients referred to the Vanderbilt Movement Disorders Clinic for consultation on various symptomatic movement disorders. This clinic has a large southeastern US regional presence covering five states.

The protocol for the chart review was to evaluate every chart for the history of welding as an occupation, for any length of time, as reported during the routine clinical interview. Among the remaining unselected charts, four controls to one welder were randomly chosen to serve as a comparison group. From each chart the following data were extracted and tabulated: (1) current age, (2) age at onset of movement disorder, (3) characteristics of the movement disorder related to the initial office visit and (4) ancillary data supporting the manganese toxicity. The movement disorder, which prompted the patient visit was cate-

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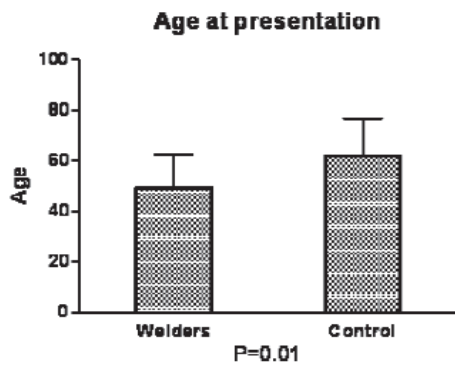


Fig. 1. The mean age at presentation in welders and controls.

gorized as the most appropriate of either: 1) ataxia, 2) chorea, 3) dystonia, 4) myoclonus, 5) parkinsonism, 6) restless legs syndrome, 7) spasticity, 8) tremor, or 9) other. If more than one movement disorder was present (e.g. chorea and dystonia), only the primary coded diagnosis was recorded. Features of the studied movement disorder included diagnosis, progression, and response to therapy. Objective data for manganese toxicity could include a brain MRI or manganese levels in blood or urine that were obtained during the routine clinical evaluation.

Statistical comparisons were made among the groups. For the age, the t-test was used. For the other parameters, such as the prevalence of each movement disorder, the chi-squared analysis was performed in 2x2 contingency tables.

Results

A total of 1126 patient charts were reviewed. Eleven patients were welders, none of which currently worked in that field. The forty-one patients from the comparison group included six homemakers, 5 retired persons, 5 office workers, 4 unemployed, and 2 farmers. The rest of the group consisted of handyman, window manufacturer, factory worker (non-welding), physician, nurse anesthetist, mail sorter, two who were chronically disabled (MR and TBI) and 7 were either unknown or not employed. The age at presentation was slightly different from the manganese group, presenting younger patients, (welders – 49.4 vs control – 62.1, $p < 0.05$), this remained significant when the unknown/unemployed person was added to welders (Fig. 1).

Within the welder group, the parkinsonism and dystonia were the most frequent primary movement disorders (27 % each) on examination, followed by the tremor and restless legs syndrome (18 % each). In the control group, the Parkinson’s disease was the most frequent (24 %), followed by dystonia (20 %), parkinsonism and tremor (12 % each). Statistical comparisons among the nine movement disorder categories showed no statistically significant differences in the prevalence (Fig. 2). There was no change in the level of significance when the unknown/unemployed were added to the welding group. In addition, the parkinsonism patients from both groups were all dopaminomimetic-

therapy responsive, showing at least a good symptomatic response as documented by the treating movement disorder’s specialist, when follow up was available. Four patients in the welding group had elevated urine manganese levels (< 2.1 mcg/24 hour, normal < 1.5) and three had elevated blood manganese levels (2.3–9.2 mcg/L normal < 7.9). No urine or blood manganese data was available in the control group. Totally, 55 % of patients in the welding group had elevated manganese levels in either blood or urine. Six of the welders had a MRI of the brain that did not show any hyper-intensity in the basal ganglia.

Discussion

Our data is consistent with the prior reports that parkinsonism patients, who were welders, appear clinically similar to non-welders, but may be younger at onset (9). In addition, the prevalence of other movement disorders in patients who were welders appears to be similar to the prevalence in non-welders.

Interestingly, all our parkinsonism patients showed a positive response to dopaminomimetic therapy. This is consistent with one report (9) but contradictory to another (15). This discrepancy could be explained by the sampling error, but there may be heterogeneity within the parkinsonism population as well. It is possible that a dose-dependent relationship exists between the manganese exposure and the response to dopaminomimetic therapy. In this scenario, welders with less exposure might maintain a response to treatment. The welders also showed a younger age of onset than non-welders, which is consistent with the previous report (9). This remained true when the unknown/unemployed person’s from the control group were included in the welder group.

Furthermore, many welders in our population showed increased blood or urine levels of manganese. This suggests that many welders do absorb manganese. However, without manga-

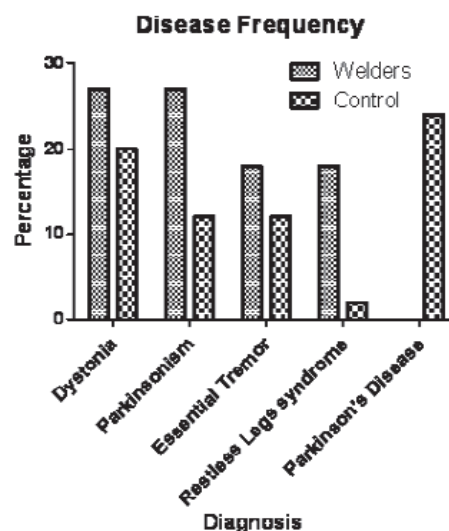


Fig. 2. Frequency of diagnosis in welders and controls.

nese levels in the comparison group, we cannot tell whether the elevated manganese levels were due to welding or due to other sources, such as drinking water or other environmental exposures.

Clearly, the small number of subjects in this study precludes the ability to generate definitive conclusions from this data. In addition, movement disorders clinics often have a skewed patient population that favors more complicated patients. However, it would appear that any relationship between manganese and movement disorders is complex, since not all welders developed parkinsonism or dystonia. In future, we hope to conduct a longitudinal study of welders examining manganese levels over time. We also plan to measure manganese levels in control subjects to determine if welders have a higher incidence of elevated manganese levels.

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Received October 10, 2008.

Accepted March 6, 2009.