

Abnormal Arm Tone, Cigarette Smoking and Use of Blood Pressure Medication in a Sight Enhancement Clinic Population

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1. Introduction

There are three pigmented tissues originating from neural crest which frequently degenerate during aging in industrialized societies: the pigmented epithelium of the eye, the substantia nigra of the thalamus and the pigmented cells of the organ of Corti. Each of these tissues once developed does not regenerate following loss. They must last the insults of a lifetime for the elderly to see clearly, hear well, and have smooth coordination. Is degeneration of these tissues interrelated? Are they influenced by common risk factors?

Three diseases relate to degeneration of the pigmented tissue of the thalamus: Parkinson's disease, paratonia, and essential tremor.

Three diseases relate to degeneration of the pigmented tissue of the thalamus: Parkinson's disease, paratonia, and essential tremor. The expected prevalence of these diseases is shown in Table 1^{1,2,3}. Each of these diseases may result in tremors and/or abnormal arm tone. Although tremors and abnormalities of arm tone have individual characteristics⁴, for statistical reasons, this study combines the patients with abnormal arm tone relating to diseases of the thalamus and contrasts them to those with normal arm tone. These

Table 1

Expected prevalence of degenerative diseases of the thalamus

| | | AGE | |
|-------------|-------|-----|----------------|
| Parkinson's | 65-74 | | 639 / 100,000 |
| | 75 + | | 1148 / 100,000 |
| Paratonia - | 65-69 | | 6% |
| | 70-74 | | 10% |
| | 75-79 | | 12% |
| | 80 + | | 21% |

Essential Tremor 1-10 in 100,000

diseases also have common factors. Prevalence of Parkinson's disease is found twenty-four times the expected among those with essential tremor⁵. Parkinson's disease shares with paratonia high incidence of the gabeller reflex and the nuchocephalic reflex².

Age related maculopathy is found in 9.6% of white males and 6.9% of white females age 70 and over⁶. The Framingham study of patients who developed age related maculopathy showed association with weak hand grip many years previous to the development of disease⁷. This study questions whether there is increased prevalence of abnormal arm tone among patients with macular degeneration. Combined degeneration of the pigmented tissues of the thalamus and retina might account for the Framingham finding. Also questioned is if hearing loss is more frequent in either patients with age related maculopathy or abnormal arm tone. Abnormal hearing is predicted among 25-50% of those aged 65 and over⁸. Light coloured eyes have been associated with hearing loss⁹ and age related maculopathy^{10,11}. Other risk factors associated with age related maculopathy include: age, smoking habits¹², hypertension^{13,14}, family history of age related maculopathy¹⁰, chemical exposure¹⁰, history of lung disease⁷.

Abnormality in lipids has been suggested in age related maculopathy¹⁵. The presence of corneal arcus was noted as it is associated with lipid abnormalities¹⁶. Exposure to light has been suggested as a factor in macular degeneration.

The interaction of the three diseases and diabetes is examined. The expected prevalence of diabetes is 9/100 in those aged 70 and over¹⁷.

2. Materials and Methods

The low vision clinic at the University of Alberta is the only clinic doing visual rehabilitation in the Northern half of Alberta with a population of 1 million. Patients are referred by regional ophthalmologists. History was ascertained by one of two trained interviewers. Smoking history was recorded in pack years to ascertain lifetime exposure. A pack a day for one year equals one pack year. Passive smoking was not estimated as there is no way to quantify lifetime exposure. Patients were asked if they had ever been on hypertensive medication and if they had ever had lung disease or a diagnosis of diabetes. They were asked if they had a relative with blindness associated with macular

Table 2**Age by gender distribution of study population**

| AGE | MALE | FEMALE | TOTAL |
|-------|------|--------|-------|
| 65-69 | 7 | 16 | 23 |
| 70-74 | 22 | 43 | 65 |
| 75-79 | 25 | 62 | 87 |
| 80 + | 56 | 92 | 148 |
| | 110 | 213 | 323 |

Table 3**Age by sex distribution of patients with age related maculopathy and visual loss from other causes**

| | ARM | | OTHER | |
|-------|-----|-----|-------|----|
| | M | F | M | F |
| 65-69 | 3 | 10 | 4 | 6 |
| 70-74 | 14 | 29 | 8 | 14 |
| 75-79 | 19 | 44 | 6 | 18 |
| 80 + | 48 | 78 | 8 | 14 |
| | 84 | 161 | 26 | 52 |

degeneration, other or unknown causes. They were asked if they had ever worked with or been exposed to non specific chemicals and if they were aware of any hearing loss.

Patients aged 65 and over seen in the low vision clinic during a two year period were classified as to whether visual loss was due to age related maculopathy or other causes.

The presence or absence of any tremor was noted. While patients were requested to relax, each arm was passively moved to determine if arm tone was normal or abnormal. Normal arm tone was present if the arm moved easily with no rigidity, cog-wheel motion, intermediate opposition or catching. Two observers noted arm tone and eye colour. The cornea was examined with the +10.00 D ophthalmoscopic lens to determine if it was clear or otherwise. Corneal arcus was noted if a distinct white ring was present separated from the edge of the cornea by a clear zone. Confirmation of referred retinal diagnosis was done visually where possible. Those in whom retinal diagnosis was impossible due to more anterior pathology were noted and classified as non age related maculopathy. Data analysis was done using the statistical package for the social sciences.

3. Results

A total of 323 patients were enrolled. Age and gender distribution is shown in Table 2. Visual loss related to age related maculopathy and other causes is shown

in Table 3. The most frequent causes of other visual loss were diabetic retinopathy (19), glaucoma (13), high myopia (7), cataract (4). Rarer causes of visual loss relating to trauma, genetic and metabolic diseases of the eye accounted for the other 33 cases.

Abnormal arm tone was present in 50 patients. Table 4 shows those with abnormal arm tone by age. Table 5 shows the expected percentage of paratonia by age² and the percentage of those

with abnormal arm tone by age and smoking habit. Higher than expected percentages of those with abnormal arm tone was found for those smoking 35-124 pack years aged 70 and over. Table 6 shows the expected percentage of paratonia and the percentage of those with abnormal arm tone by age and gender. Rates were double for males age 75-79. Table 7 shows the relationship between smoking habit and arm tone ($\chi^2 = 9.17$, $p < 0.0102$). Table 8 shows that smoking habits were significantly associated with gender ($\chi^2 = 97.11$, $p < 0.0005$). Those smoking 35-124 pack years were more likely to have lung disease ($\chi^2 = 8.75$, $p < 0.02$) and for males more likely to have corneal arcus ($\chi^2 = 7.04$, $p < 0.03$). The interactions of the three diseases associated with pigment tissues of the brain and risk factors is shown in Table 9. Women with abnormal arm tone were more likely to have good hearing than those with normal arm tone ($\chi^2 = 7.39$, $p < 0.02$) and to have been treated with hypertensive medications ($\chi^2 = 4.01$, $p < 0.05$). Abnormal arm tone related to the presence of tremor ($\chi^2 = 151.91$, $p < 0.0005$). Tremor was so disabling that approximately $\frac{1}{3}$ of those with abnormal arm tone were unable to hold telescopes. There were no other relationships between the three pigment tissue diseases. Having a light coloured iris was associated only for men with

Table 4**Patients with abnormal arm tone by gender and age**

| | Abnormal Arm Tone | | Total |
|-------|-------------------|----|-------|
| | M | F | |
| 65-69 | 1 | 0 | 1 |
| 70-74 | 1 | 4 | 5 |
| 75-79 | 7 | 7 | 14 |
| 80 + | 14 | 16 | 30 |
| | 23 | 27 | 50 |

Table 5**Expected % of paratonia *(Jenkyn) and % of abnormal arm tone (AAT) by smoking habit**

| | | STUDY POPULATION | | | | | | | | |
|-------|------------|------------------|-------|-----|-----------------|-------|-----|-------------------|-------|-----|
| Age | Expected % | Never Smoked | | | - 35 Pack Years | | | + = 35 Pack Years | | |
| | | AAT | Total | % | AAT | Total | % | AAT | Total | % |
| 65-69 | 6% | 1 | 11 | 9% | 0 | 7 | 0% | 0 | 4 | 0% |
| 70-74 | 10% | 1 | 27 | 4% | 1 | 21 | 5% | 3 | 15 | 20% |
| 75-79 | 12% | 6 | 44 | 14% | 4 | 28 | 14% | 4 | 13 | 31% |
| 80 + | 21% | 18 | 87 | 21% | 3 | 33 | 9% | 9 | 26 | 35% |
| | | 26 | 169 | 15% | 8 | 89 | 9% | 16 | 58 | 28% |

Table 6

Expected percentage of paratonia *(Jenkyn) and % of abnormal arm-tone (AAT) by gender

| | | STUDY POPULATION | | | | | |
|----------|-----|------------------|-------|-----|--------|-------|-----|
| Expected | | MALE | | | FEMALE | | |
| Age | % | AAT | Total | % | AAT | Total | % |
| 65-69 | 6% | 1 | 7 | 14% | 0 | 16 | 0% |
| 70-74 | 10% | 1 | 22 | 6% | 4 | 43 | 9% |
| 75-79 | 12% | 7 | 25 | 28% | 7 | 62 | 11% |
| 80 + | 21% | 14 | 56 | 25% | 16 | 92 | 17% |
| | | 23 | 110 | 21% | 27 | 213 | 13% |

Table 7

Relationship between smoking habit and armtone (Chi square test $p < 0.0102$; 7 pipe smokers with normal armtone not included)

| | Normal Armtone | Abnormal Armtone |
|----------------------|-------------------|---------------------|
| Non-Smokers | 143 | 26 |
| 1-34 pack-years | 81 | 8 |
| ≥ 35 pack-years | 42 | 16 |
| Total | 266 | 50 |

macular degeneration ($\chi^2 = 16.74$, $p < 0.0005$). It was not associated with use of blood pressure medication. The age related maculopathy group had the following characteristics: 76% used medication for high blood pressure, 57% had hearing loss, 29% had a relative with visual loss due to maculopathy or unknown cases, 8% admitted chemical exposure, 15% had a diagnosis of diabetes, 26% had corneal arcus. Age related maculopathy ($\chi^2 = 15.55$, $p < 0.002$) and tremor (women only - $\chi^2 = 10.15$, $p < 0.02$) were both associated with older age. Sixteen patients had all three degenerative conditions.

4. Discussion and Conclusions

Aging degeneration of the three pigment tissues of the brain occurs independently for each tissue. In this study risk factors are not commonly shared. Some risk factors associated in the literature with macular degeneration were also associated with abnormal arm tone including smoking and hypertension. In the Baltimore study¹⁰, patients with diabetes were eliminated due to common shared risk factors such as hypertension and diabetic retinopathy¹⁴. Our control

group was visually impaired. Many had diabetes. Risk factors may be common for several diseases such as exposure to chemicals and optic atrophy.

Although we cannot halt the passing of time or alter our genetic heritage, perhaps incidence of tremor and abnormal arm tone among the aged can be reduced by smoking less than 35 pack years.

Although we cannot halt the passing of time or alter our genetic heritage, perhaps incidence of tremor and abnormal arm tone among the aged can be reduced by smoking less than 35 pack years. Smoking 35 pack years or more was significantly a male custom during the life span of those now 65 and over. The outcome of the changed smoking habits following 1940 where women were encouraged to smoke may lead to excessive numbers of the elderly with abnormality of arm tone.

The etiology of Parkinson's disease and related diseases¹⁸ is varied including

virus triggering, autoimmune process, carbon monoxide poisoning¹, street drug use¹⁹, psychiatric drug use¹ and minor stroke relating to hypertension, but not cigarette smoking²⁰. Smoking heavy amounts increases carbon monoxide²¹ and lead blood levels²². Systemic lead poisoning of rabbit retinal pigment epithelium has been shown²³. There may be a similar reaction in the substantia nigra and in the pigmented epithelium of the eye to chronic chemical poisoning. Damage from a multitude of chemicals in cigarette smoke may account for our findings. The use of hypertensive medication was associated with women having abnormal arm tone. Whether the damage to the thalamus relates to the vascular insults of hypertension itself or chemical poisoning from one of the commonly used drugs must be determined.

Warning: the one who falls in love with the man in the cigarette ad must love well, for in old age she may be his hands and if he is blue eyed, his vision.

Pathologic studies of the choroid of age related maculopathy have not shown consistent findings of atherosclerosis in all eyes²⁴. Perhaps macular degeneration and degeneration of the thalamus are the end result of several different mechanisms of damage. Separating patients into groups according to those influenced by genetics, atherosclerosis, hypoxia and chemical poisoning may be helpful in understanding these diseases.

Rehabilitation of the visually impaired with profound tremor is severely limited as aids are difficult to hold. Tremor has a high social cost including early retirement and embarrassment²⁵. The use of a stand magnifier occasionally facilitates reading. Telescopes and microscopes may be mounted on spectacles for these patients. Prevention of abnormality of arm tone should be encouraged.

Warning: excessive cigarette smoking may lead to abnormal arm tone which is associated with tremor in old age.

Warning: the one who falls in love with the man in the cigarette ad must love well, for in old age she may be his hands and if he is blue eyed, his vision.

Table 8

Relationship between gender and smoking habit (Not shown — 7 male pipe smokers; Chi-Square = 97.11 P < 0.0005)

| | Never Smoked | 1 - 34 pack years | 35 - 124 pack years | |
|--------|-----------------|----------------------|------------------------|-----|
| Female | 152 | 47 | 14 | |
| Male | 17 | 42 | 44 | |
| Total | 169 | 89 | 58 | 316 |

Table 9

Summary of risk facts and degenerative disease and P value using Chi-Square test

| | Age | Male gender | Eye Colour | Pack Years | Blood Pressure | Family History | Chemicals | Work | Diabetes | Arcus | Registered blind | Lung |
|----------------------------|------------|----------------|---------------|---------------|-------------------|-------------------|-----------|------|----------|-------|---------------------|------|
| Age related maculopathy | 0.0002 | NS | 0.0002 M | NS | NS | 0.06 NS | NS | NS | 0.*0005 | NS | NS | NS |
| Abnormal artrate | 0.06 NS | 0.06 NS | NS | .02 | 0.05 F | NS | NS | NS | NS | NS | NS | NS |
| Tremor | 0.02F | NS | NS | NS | 0.04 F | NS | NS | NS | NS | NS | NS | NS |
| Hearing | NS | NS | NS | NS | 0.04 M | NS | NS | NS | NS | NS | NS | NS |

NS - not significant

* - negative association

M - association for male only

F - association for female only

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