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Vibration white finger and Dupuytren's contracture: are they related?

P. R. Thomas and D. Clarke
Middlesbrough General Hospital, Cleveland, UK

Between 1988 and 1990, 500 claimants were assessed and considered to have vibration white finger (VWF). Of these, 137 were under 45 years of age and none had Dupuytren's contracture of the remaining 363, 311 were aged 50–85 years, and of these 62 (19.9 per cent) had Dupuytren's contracture. Statistically, this prevalence was significantly higher than that in a control group of 150 men of similar age distribution (10.7 per cent). As far as can be ascertained, this is the first study to indicate that there may be a causal relationship between VWF and Dupuytren's contracture, and the possible theoretical reasons for this are discussed. It is suggested that further studies are required to confirm or refute the findings.

INTRODUCTION

Vibration white finger (VWF) is a form of secondary Raynaud's phenomenon of occupational origin usually associated with long-term use of hand-held vibrating tools[1]. Symptoms of tingling and numbness in the early stages may be followed by periodic blanching attacks of the fingers, especially on exposure to cold. Although the condition was first described early this century[2] it was not until April 1985 that it became recognized in the UK as a prescribed industrial disease by the DHSS[3]. Numerous retrospective surveys have indicated prevalences of 50–70 per cent in chippers and grinders[4], and hence it could have been anticipated that prescription would prompt a flood of claimants for assessment, especially in areas of heavy industry. Indeed, between 1988 and 1990 one of the authors examined over 500 such subjects, all from the conurbation of Teesside consisting of the boroughs of Middlesbrough, Stockton-on-Tees, Hartlepool and Langbaurgh with a total population of approximately 500 000. During this time one of the authors was impressed by what he regarded as an excessive prevalence of Dupuytren's contracture among the claimants. As Dupuytren's contracture is not regarded as part of the VWF syndrome it was decided to pursue the matter further to see if this clinical impression was correct, and if so, whether it might indicate a common aetiological factor between the two conditions.

SUBJECTS AND METHODS

Between 1988 and 1990, 500 claimants who had been referred were considered to have the features of vibration white finger. Subjects were initially assessed by a standardized questionnaire consisting of full occupational history, past and present medical history, medication and smoking habits and finally symptoms. Particular attention was made to the frequency and distribution of any blanching attacks, and the degree of impairment at work, in the home, and during leisure activities. The examination consisted of Adson's test for thoracic outlet compression, assessment of digital artery patency by Allen's test and Doppler ultrasound probe, testing sensation to light touch and ability to discriminate between touch and pinprick, and application of the Tinel and Phalen tests for carpal tunnel syndrome.

In Adsons test there is reduction or occlusion of the radial pulse when the arm is elevated or shoulder braced and the head turned to the tested side. A bruit may also be audible over the subclavian artery as it is compressed over the scalenus anterior muscle.

In Allen's test the radial and ulnar arteries are compressed at the wrist by the examiner while the subject drives blood out of the palmar arches and digital vessels by opening and closing the hand. On release of each artery prompt flushing of the hand is normal. Delayed flushing of greater than 5 s indicates spasm or occlusion of the digital vessels.

The examiner conducts Tinel's test by placing his index finger over the subject's carpal ligament and striking it with a tendon hammer. The test is positive if the subject experiences tingling distal to the wrist in the distribution of the median nerve.

In Phalen's test the subject raises his arms horizontally to chin level and allows both hands to flex at the wrist by gravity for three minutes. Tingling in the fingers indicates compression of the median nerve in the carpal tunnel.

Cold provocation tests were omitted as normal results do not exclude VWF[1,5]. Subjects considered to have VWF were staged on the Taylor and Pelmear scale[6] (see *Table 1*). All stages of Dupuytren's contracture were included, from a single palmar nodule to advanced

Correspondence and reprint requests to: Dr P. R. Thomas, Middlesborough General Hospital, Ayresome Green Lane, Middlesborough, Cleveland TS5 5AZ, UK

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flexion contractures. A control group consisted of a consecutive series of 150 men, 50–85 years of age, who were examined for the presence or absence of Dupuytren's contracture following admission for elective or emergency treatment to a general surgical ward at Middlesbrough General Hospital. An occupational history was also taken. None of the controls admitted to symptoms consistent with VWF.

RESULTS

Of the 500 subjects considered to have VWF, 499 were male and 1 female. The age range was 25–85 years. Dupuytren's contracture was present in 68 of the subjects (13.6 per cent). *Table 2* shows that no subject under the age of 45 ($n = 137$) had Dupuytren's contracture. There is then a progressive increase in prevalence with age, from 12.9 per cent in 45–54 years old group ($n = 124$), to 20 per cent in 55–64 years old group ($n = 170$) and up to 29.5 per cent between 65 and 74 years ($n = 61$). *Table 3* shows that 70 per cent of subjects were in stage 2 or above on the Taylor and Pelmear scale.

Table 4 shows the presence of Dupuytren's contracture in relation to the Taylor and Pelmear stage of VWF. Of 63 subjects in the earliest stage OT/ON, 20 had Dupuytren's contracture (31.7 per cent). Otherwise, there was no obvious relationship between the stage of VWF and presence of Dupuytren's contracture, the prevalence ranging from 9.8 to 14.3 per cent (numbers were too small in Stage 4).

Table 5 shows that the vast majority of VWF subjects were employed as chippers and grinders in either the steel or ship building industry.

Table 6 shows the relationship between the duration of exposure to vibrating tools and the presence of Dupuytren's contracture.

It can be seen from *Table 7* that irrespective of the stage on the Taylor and Pelmear scale, the majority of subjects in each stage (range 64–76 per cent) had an exposure to vibrating tools of 20 years or more.

CONTROL GROUP

Dupuytren's contracture was present in 16 (10.7 per cent) out of 150 men aged 50–85 years (mean age, 64.1). Of the 150 controls, 102 had performed heavy manual

Table 1. Taylor and Pelmear scale (1975)

Stage	*Condition of digits*	*Work and social interference*
0	No symptoms	None
0T	Intermittent tingling	None
0N	Intermittent numbness	None
1	Blanching of one or more fingertips ± tingling and numbness	None
2	Blanching of one or more fingers with numbness, usually confined to winter	Slight interference with home and social activities: no interference at work
3	Extensive blanching; frequent episodes in summer as well as winter	Definite interference at work, at home and with social activities; restriction of hobbies
4	Extensive blanching; most fingers: frequent episodes summer and winter	Occupation changed to avoid further vibration exposure because of severity of signs and symptoms

Table 2. Age distribution and presence of Dupuytren's contracture (VWF subjects)

Age (years)	*Dupuytren's absent*	*Dupuytren's present*	*Percentage*
25–34	42	0	0
35–44	95	0	0
45–54	108	16	12.9
55–64	136	34	20
65–74	43	18	29.5
75–85	8	0	0
Total	432	68	13.6

Table 3. Taylor and Pelmear stage distribution of 500 VWF cases

Age (years)	*Stage*						
	OT/ON	*1*	*1–2*	*2*	*2–3*	*3*	*4*
25–34	4	9	0	20	1	8	0
35–44	13	19	3	37	3	19	1
45–54	15	18	4	56	6	25	0
55–64	26	21	3	74	7	38	1
65–74	5	10	4	19	8	14	1
75–85	0	0	0	8	0	0	0
Total	63	77	14	214	25	104	3

Table 4. Presence of Dupuytren's contracture in relation to Taylor Pelmear staging

	Stage						
	OT/ON	*1*	*1–2*	*2*	*2–3*	*3*	*4*
Dupuytren's absent	43	68	12	193	21	93	2
present	20	9	2	21	4	11	1

Table 5. Occupations of the VWF subjects

	No.	*Dupuytren's*	*Percentage*
Steel industry and shipbuilding (chippers, grinders)	431	58	13.5
Miners	10	1	10
Construction, demolition	57	9	15.8
Other vibrating tools	2	0	0

Table 6. Duration of exposure to vibrating tools (unknown in 2) and presence of Dupuytren's contracture

Exposure (years)	*No.*	*Dupuytren's*	*Percentage*
< 10	24	1	4
10–19	125	17	13.6
20–29	140	20	14.3
30+	209	30	14.3
	498	68	

Table 7. Relationship between duration of exposure and Taylor and Pelmear stage

Exposure (years)	0T/0N	1	1–2	Stage 2	2–3	3	4
<10	6(10%)	4 (5%)	—	7 (3%)	2	5 (5%)	—
10–19	16(26%)	24(31%)	7	54(25%)	4	20(19%)	—
20–29	15(24%)	17(22%)	4	60(25%)	5	36(35%)	3
30+	25(40%)	32(42%)	3	92(42%)	14	43(41%)	—

Table 8. Difference in prevalence of Dupuytren's contracture

Dupuytren's	VWF	Control
Present	62(19.9%)	16(10.7%)
Absent	249	134
Total	311	150

labour, 29 were clerks, teachers, shop assistants etc, the remaining 19 having a variety of semi-skilled or unskilled occupations.

COMPARISON BETWEEN VWF SUBJECTS AND CONTROLS

Of the 500 subjects with VWF, none below the age of 45 years ($n = 137$) had Dupuytren's contracture, leaving 363 remaining. Of these 363, 311 were aged 50–85 years (mean age, 66) and these were compared to the Control group, also aged 50–85 years (mean age 64.1).

Table 8 shows the difference in prevalence of Dupuytren's contracture between the two groups, and a Chi-square test reveals that the difference is statistically significant ($\chi^2 = 6.21$, one degree of freedom, $p < 0.02 > 0.01$).

DISCUSSION

Our results indicate that men with vibration white finger aged 50–85 years have a statistically significant increased prevalence of Dupuytren's contracture (19.9 per cent) when compared with a control group (10.7 per cent), and seem to confirm the impression gained by us thereby prompting this study. Certainly, chronic trauma of occupational origin has long been thought to contribute to Dupuytren's contracture but statistical evidence has been conflicting[7]. Herzog[8] found a prevalence of approximately 4 per cent in three groups of approximately 500 each of steelworkers, miners and clerks over the age of 40, with no difference between the groups. Similarly, Early[7] concluded that there is no relationship between the type of occupation and the incidence of contracture in men, with an average prevalence of 8.1 per cent in three different cities (age range, 45–75).

Mikkelsen[9], however, came to a different conclusion. He found 901 cases of Dupuytren's contracture out of 15 950 citizens in the Norwegian town of Haudesund, the prevalence ranging from 5.3 per cent in non-manual workers up to 14.7 per cent in heavy manual workers, but insufficient detail was given about the age groups of the subjects. Indeed, only a small number of reports have provided enough data to enable meaningful comparisons to be made between different populations. Problems have been those of using selected populations, not separating the sexes, not stating age distributions, and not including all stages of Dupuytren's contracture from a single palmar nodule to advanced contractions. However, the one statistical factor upon which all writers are agreed is increasing incidence with age[7]. In our study there were no cases in 137 men aged 25–44 years, but the incidence progressively increased with age to 29.5 per cent between 69–74 years (18 out of 61).

Before discussing possible explanations for the difference between VWF and control groups, it is first necessary to compare our control group with others.

The prevalence of Dupuytren's contracture in our control group (10.7 per cent) is slightly greater than Early's subjects (8.1 per cent) and much greater than those of Herzog (4 per cent)[7,8]. Such variations in average incidence within the same country may have a racial or genetic explanation. Ling[10] has shown that genetic factors are important in Dupuytren's contracture. The condition is rare in non-Caucasions and within Europe is most common in Scandinavia and the British Isles. It seems to be even more common in white Australians, being present in 17 per cent of men over the age of 65 years[11]. One study demonstrates a negative correlation between the average prevalence of Dupuytren's contracture and the population of the country[7]. This may represent a lesser dilution of the genetic factor in emigrants to a small host population, for example Australia or Canada. A similar situation might explain the differences between our study and others. For example, Herzog's subjects (4 per cent) were from Rotherham, Sheffield and Manchester[8], and Early's subjects (8 per cent) from Crewe, Leigh and Manchester[7]. in our study, whereas Stockton-on-Tees and Hartlepool are old communities, the majority of our subjects came from Middlesbrough (population, 143 000) which was founded only 150 years ago after the discovery of iron ore in the Cleveland Hills, and a large proportion of the present population is descended from the Irish and Welsh workers who moved to develop the industry.

It is interesting that our findings are similar to those of Hueston[12] in Victoria, Australia, with an immigrant population of similar origins. If we ignore any possible effect of VWF on the causation of contracture, our incidence of 18.7 per cent in men over the age of 45 years in the VWF group is much higher than the findings of Herzog and Early in the same age group[7,8].

There are over 500 articles in the world literature on

vibration white finger[5]. Despite this, as far as we can ascertain, there are few references to an association between VWF and Dupuytren's contracture. Taylor[4] states that Dupuytren's contracture in long-term (20–40 years) pneumatic drill operators is probably due to direct mechanical trauma and that present evidence points to vibration being a possible but small aggravating factor. Beck[13] found an increased prevalence of Dupuytren's contracture in workers using pneumatic tools, compared to other workers, but unfortunately failed to analyse the age distribution of the cases. However, Bauer *et al.*[14], continuing the earlier work of Wilflingseder *et al.*[15] demonstrated vasospasm in the digital arteries of 77 per cent of 94 cases of Dupuytren's contracture, when exposed to cold, similar to that seen in primary Raynaud's disease. The studies were done using finger venous occlusion plethysmography. Also, Murrell[11] and Kischer and Speer[16] have shown that the microvessels in the palmar fascia in Dupuytren's contracture are narrowed with thickened endothelial cells and multiple layers of circumferential laminae. All these studies are compatible with our findings of an association between VWF and Dupuytren's contracture which may indicate an aetiological relationship.

One interesting feature, difficult to explain if one is to postulate an aetiological association related to vasospasm, is why so many subjects with Dupuytren's contracture were in the earliest stage of VWF, OT/ON. One possible explanation is that these subjects put in a claim because they thought that Dupuytren's contracture was identical to VWF. As far as we can ascertain, this was not the case. Indeed, all subjects were considered to have VWF by the examiner, and although they did not complain of blanching attacks, some did have objective abnormalities on examination. The fact of a latent period also indicates that some of these subjects will subsequently enter later stages of VWF.

In conclusion, we believe that the statistical association which we have found between subjects with vibration white finger and Dupuytren's contracture may indicate an aetiological relationship. However, our findings need to be confirmed or refuted by others. Undoubtedly since VWF became a prescribed industrial disease in the UK in 1985 there will be several large series of claimants similar to ours, and it would be interesting if comparisons could be made.

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