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Manual Milking: A Risk Factor for Carpal Tunnel Syndrome.

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Abstract

Carpal tunnel syndrome (CTS) is the most common entrapment syndrome. Occupations which include repetitive and forceful wrist and arm movement result with CTS. Our goal was to investigate the frequency of CTS among people who are manually milking their animals. Methods: One hundred and sixty hands of 80 women dealing with manual milking (manual milking group) and 40 hands of 20 healthy unemployed women (control group) were clinically and electrophysiologically evaluated for CTS. Results: In manual milking group, CTS was clinically diagnosed in 66 of 160 hands (41.25%) by physical examination and was electrodiagnostically detected in 60 hands (37.5%). Two hands (5%) were diagnosed as CTS clinically and electrodiagnostically in the control group. Clinically and electrodiagnostically estimated relative risks of developing CTS were respectively 13.34 and 11.40 times greater in manual milking group than controls. CTS frequency was increased with age, and correlated with starting age of milking. Conclusion: These results indicate that manual milking may be a risk factor for CTS development.

***Key words**: Carpal tunnel syndrome; Manual milking; Occupation*

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Introduction

Carpal tunnel syndrome (CTS) is the most widely known entrapment neuropathy in humans. Personal risk factors of CTS are systemic diseases such as diabetes mellitus, rheumatologic diseases, traumas to wrist and occupational diseases involving repetitive wrist and arm movements [1-4]. The occupations which have increased risk for CTS include; assembly workers [5]; food industry, especially meat and fish processing [6]; garment industry [7]; boot and shoe manufacturing [8]; supermarket cashiers [9]; hand-made carpet manufactory workers [10]; fishnet workers [11], and railroad workers [12].

During manual, milking forced flexion of fingers followed by mild flexion of wrist and ulnar deviation repetitively occur approximately 40-50 times per minute. The daily milking takes approximately 20 minutes for each cow and 10 minutes for sheep or goat. This job has been seen an occupational risk for CTS. However, there is no analytical study including case-control types in the literature showing the relation between manual milking and CTS. However, Kouyoumdjian and de Araújo showed in their retrospective study that 1.38% of patients with CTS were associated with manual milking [13]. They concluded that manual milking could be considered a natural model for occupationally related CTS [13]. Manual milking is common in families living in the rural areas of Isparta, Turkey who have small number of milk secreting animals such as cow and sheep. In the present study, we aimed to investigate the CTS frequency among people who are manually milking their animals.

Methods

People who were manually milking for more than one year in rural areas of Isparta, Turkey, were invited to the Hospital of Suleyman Demirel University by local health organizations for physical examination and electrodiagnostic tests. Two hundred and five women attended neurology outpatient clinic. All the cases were females. Manual milking is mostly done by women in this region. Sixty three of them having CTS risk factors other than manual milking were not included in the study. The risk factors were obesity, wrist trauma, and several medical disorders such as rheumatoid arthritis, metabolic and endocrine disorders. Forty four women were also excluded from the study because of having occupations with increased CTS risk such as hand-made carpet workers and woolen sweater knitters besides manual milking.

Electrophysiological tests were performed in the rest 98 cases. All electrodiagnostical tests were done with the patient in supine position, in a room with the temperature kept at 25 °C. All of the studies were performed with a Nihon Kohden - Neuropack MEB 5504K. The filter band-pass was 2 Hz to 3 kHz for motor studies and 20 Hz to 3 kHz for sensory studies. The compound muscle action potential (CMAP) was recorded with surface electrodes from the abductor pollicis brevis muscle. The median nerve was stimulated 8 cm proximal to the anodal electrode by a hand-held stimulator with 2 cm inter-electrode distance. Stimulus duration was 0.2 ms, sweep speed was 2 ms/division and amplitude gain was 5 mV. Measurements were done by a tape measure. Sensory nerve action potentials (SNAP) were obtained orthodromically and were recorded by ring electrodes placed at the proximal and distal interphalangeal joints. The distance between the stimulator and recording electrode was 14 cm. Sweep speed was 2 ms/division and gain was 10 μV.

An average of ten responses for sensory and five responses for motor evaluation was obtained from each stimulation site. Amplitudes of SNAP and CNAP were measured from peak-to-peak and distal latency from the onset point. Ulnar sensory and motor nerve conductions were also evaluated with the same method. Concentric needle EMG investigations were performed to exclude an additional or alternative disorder. In electrophysiological examination, a distal latency difference of greater than 0.5 msec between median and ulnar sensory nerves were accepted as the hallmark of CTS.

Eighteen of 98 cases having polyneuropathy, cervical radiculopathy and brachial plexopathy were also excluded from the study. The rest 80 cases having no CTS risk factor other than manual milking were evaluated by both electrophysiologically and clinically for risk of CTS.

For clinical evaluation, cases were first questioned for symptoms consistent with CTS and then examined especially for Tinnel's test, and Phalen's and reverse Phalen's signs, sensory loss in median innervated digits and atrophy of the thenar eminence. Additionally, the duration of manual milking, daily milking time and the type of milked animal were also recorded for each case. Twenty healthy, voluntary women who had no complaints of CTS and no risk factors mentioned above for CTS were studied as a control group.

The data were analyzed by SPSS for windows 9.05. Chi-Square for trends and Student's t test were used for statistical evaluation. Statistical significance was set at a p-value less than 0.05.

Results

The mean ages of manual milking group and control group were 42.75± 11.52 years (16 to 68) and 35.1 ± 12.3 years (16 to 55), respectively (t=1.060, p:0.293). Among these 80 subjects, 16 (20%) had no complaints; 42 (52.5%) had bilateral and 22 (27.5%) had unilateral complaints of CTS in the manual milking group. Sixty six of 160 hands (41.25%) were diagnosed as CTS on clinical examination. None of the subjects in the control group had complaints of CTS however; two hands (5%) were diagnosed as CTS by physical examination. In electrodiagnostic evaluation 60 hands (37.5%) (22 bilateral and 16 unilateral) were observed to have CTS in manual milking group.

In control group, electrodiagnostically proven CTS was present unilaterally in two hands (5%).

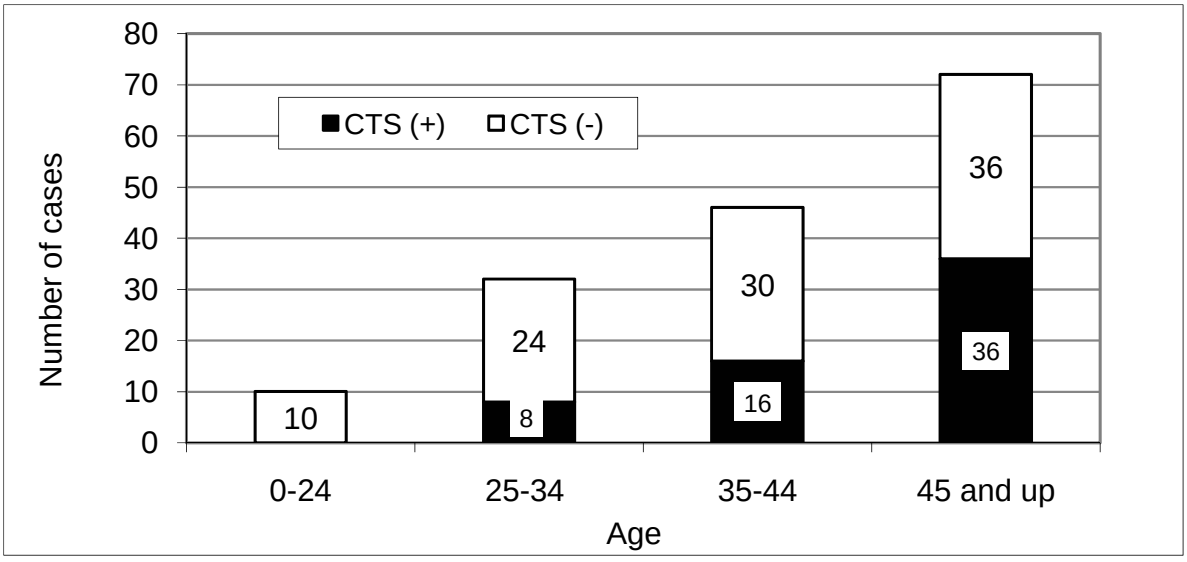

Figure: *Relation between age and carpal tunnel syndrome*

Table: The features of person manual milking.

	All hands (n=160)	**Hands with CTS** (n=60)	**Hands without CTS** (n=100)	**P***
Age	42.75±11.52	46.33±9.28	40.60±12.17	0.001
Starting age of milking	24.73±10.30	26.93±10.72	23.41±9.86	0.036
Duration of daily milking (minute)	45.25±21.98	45.00±20.46	45.40±22.94	0.912
Total milking period (year)	17.78±12.98	19.30±12.03	16.88±13.49	0.255
Total milking period (hour)	4781.50±479.34	4961.97± 4077.31	4673.22±4720.78	0.694

*The values were expressed as mean ± standard deviation. * Chi-Square for trends*

CTS was both clinically and electrophysiologically present at higher rates in the manual milking group than the control group (fisher's exact test, both p=0.000). In other words, estimated relative risk of developing CTS in manual milking group were clinically 13.34 times and electrophysiologically 11.40 times greater than the controls (95% Confidence interval clinically 3.110- 57.233 and electrophysiologically 2.654- 48.965).

In manual milking group, frequency of CTS was increased with age (Chi-Square for trends χ^2=12.593, p =0.000) (Figure).

Mean starting age of milking was 24.73±10.30 years. This mean age was 26.93 ±10.72 years in cases with CTS and 23.41 ± 9.86 years without CTS. (t =2.12, p=0.036) (Table). Duration of daily milking and total milking period were not significantly different between cases with CTS and without CTS (Table). Twenty nine of 92 hands (31.5%) milking cows and 4 of 16 hands (25%) milking sheep or goats had CTS. The type of animal milked did not affect the frequency of CTS. (OR=1.38 95% CI: 0.41-4.65).

Discussion

In the present study, CTS was diagnosed by physical examination and electrophysiologic test in 41.25% and 37.5% of hands dealing with manual milking respectively. However, only 5% of the control hands had CTS. Manual milking increased the frequency of CTS. CTS frequency in our study was also higher than that of normal population as was reported by Atroshi *et al*. [14]. In that study clinically and electrophysiologically proven CTS ratios in women were 4.6% and 5.2%, respectively.

CTS develop in workers with repetitive and forceful use of wrist. Hagberg *et al*. reviewed epidemiological studies, and reported the prevalence of CTS varying between 0.6 and 61% in the different occupational groups [15]. Kim *et al*. reported the highest prevalence of CTS in meat and fish processing plants as 73.9% [6]. Margolis and Kraus found a prevalence of 62.5% for symptoms consistent with CTS in female supermarket workers [9]. Bonfiglioli et al reported the prevalence of current CTS symptoms was higher among full-time (31.0%) than in part time supermarket cashiers [16]. Punnet *et al*. found a high CTS prevalence as %60 among garment workers [7]. In railroad workers, a total of 43.4% of the participants and 38.6% of the wrists were shown either positive or borderline findings for CTS [12]. This ratio is very close to our ratio (38.6% versus 37.5%, respectively). A CTS prevalence of 23 % among grocery store workers was reported by Osorio *et al* [17]. In our previous study conducted in the same region, Isparta, Turkey, CTS ratio was found as 22.1% in handmade carpet workers and this occupation was reported as a risk factor for CTS [10]. Barnhart *et al*. reported CTS in 15.4 % of ski manufacturing workers with repetitive jobs [18]. Jianmongkol *et al*. reported that CTS prevalence was %14.5 in workers of fishnet factory [11]. Annual incidence of 9.9% among the workers of a factory manufacturing automobile seats was estimated by Werner *et al* [19].

Manual milking involves the continuous and powerful use of finger flexor muscles. Kouyoumdjian and de Araújo reported that among 3125 consecutive patients with electrodiagnosis of CTS, 43 (1.38%) were associated with manual milking. They concluded that manual milking could be considered a natural model for occupational related CTS [13].

In general population, CTS prevalence is different in males and females. Atroshi *et al*. reported male-female ratio for CTS prevalence as 1:1.4 [14]. On the other hand, McDiarmid *et al*. reported that the prevalence of occupational CTS in males and females was equal if both worked in the same conditions [20]. In our study, all cases were females. Because the manual milking was mainly done by women in our region.

In the present study, CTS frequency increased with age. Additionally, CTS was also correlated with the starting age of milking process. This result implies that the adaptive maturation of anatomical structure of carpal tunnel's contents prevents developing CTS. On the other hand, no

correlations were found between CTS development and duration of daily milking, and total milking period. This finding suggests that CTS development was related to milking itself but not the duration. There was also no relation between type of animal and the rate of CTS. It can be concluded that manual milking may be a risk factor for CTS development especially in countries where milking machines are not yet in common use.

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Manual milking and carpal tunnel syndrome