Prevalence of complaints of arm, neck, and shoulders among computer professionals in Bangalore: A cross-sectional study

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Abstract

Introduction: Complaints of arm, neck, and shoulders (CANS) is a common problem among patients whose work involves computer use, but often ignored most importantly by the physicians partly due to not being able to appreciate the importance of taking a careful detailed occupational history of exposure to a repetitive activity involving upper arms. Upper extremity musculoskeletal disorders constitute a major portion of occupation-related illness with annual costs related to treatment and absenteeism from work ranging between $45 and 54 billion in the United States. Materials and Methods: A cross-sectional study was done to assess the factors contributing to CANS among computer professionals in Bangalore. We screened 206 professionals and 181 were administered Maastricht Upper Extremity Questionnaire (MUEQ). Chi-square and logistic regression were used. Results: Prevalence of CANS in the study group was 58.6%. Neck complaints topped the list followed by shoulder, wrist, hand, elbow, upper arm, and lower arm complaints in the descending order. Women had overall higher prevalence and significantly higher prevalence of upper limb complaints than men. Inadequate space, maintaining good posture, and repetition of same tasks have emerged as an independent factors associated with CANS. Conclusion: CANS is highly prevalent among computer professionals working in small and medium-sized companies. Provision of adequate workspace and ergonomic designs of workstations are the modifiable risk factors which can be addressed by the employers to reduce the morbidity associated with CANS. Employees could correct postures and improve work habits.

Keywords: Complaints of arm, neck, and shoulders, computer professionals, ergonomics, occupational health

Introduction

Upper extremity musculoskeletal disorders constitute a major portion of occupation-related illness with annual costs related to treatment and absenteeism from work ranging between $45 and 54 billion in the United States. Other synonyms for the disorder are cumulative trauma disorder, repetitive strain injury, work-related upper limb disorder, overuse injuries, complaints of arm, neck, and shoulders (CANS). In the United States, the Bureau of Labour Statistics estimated that in 1996, 64% of all new work-related disability cases were related to CANS. There was no universal way of labeling or defining upper extremity musculoskeletal disorders until a multidisciplinary committee arrived at a consensus of naming it as CANS. Pain, paraesthesia, and subjective weaknesses are important features of this disorder. CANS causes considerable work problems, including decreased work productivity, sickness absence absenteeism, and ultimately job loss.

The prevalence of CANS among those with occupational use of computers has been reported to be in the range of 54%–64% in European studies. A study done in Asia also revealed a similar prevalence of 64%. There are three research studies done on IT/computer professionals in Delhi, India.

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They have found the prevalence of musculoskeletal problems, which not only include complaints in arm, neck, and shoulders but also the lower back, to be around 77% approximately. In a study done by Varun Singh et al. in 2012, using Maastricht Upper Extremity Questionnaire (MUEQ), in 202 healthcare professionals/students with occupational use of computers, the prevalence of upper limb disorders was 45%.12

A Malaysian study on 110 participants published in 2015 showed neck complaints topped the list (54%) followed by shoulder complaints.13 Risk factors for the development of CANS not only include physical factors; repetitive movements, poor workstation, and awkward posture but also psychosocial demands, low social support, less break time, and high job demands at the workplace.8,14-16 CANS is a common musculoskeletal problem encountered by primary care physicians/family physicians in their practice. CANS results from repeated stress to the body’s soft tissue structures including muscles, tendons, and nerves, sustained either in their jobs as in computer professionals or in extracurricular activities. Common complaints include tendon-related disorders, such as rotator cuff tendonitis, and peripheral nerve entrapment disorders, such as carpal tunnel syndrome.17 This study aimed to determine prevalence and assess the factors contributing to CANS among computer professionals in Bangalore city.

**Materials and Methods**

A cross-sectional study was done in Bangalore in two medium-sized software companies. Computer professionals with occupational use of computers for at least 2 h per day with 1 year or more work experience were included in the study. Those with preexisting disease conditions such as diabetes, rheumatic diseases, muscle diseases, neuropathy leading to symptoms similar to CANS, congenital, or acquired upper extremity damage, and acute trauma to upper extremity were excluded from the study. Considering the prevalence of CANS to be 54% from the existing evidence, using the formula 4PQ/d^2 and an absolute precision of 7.5, sample size was calculated as 176.8 Convenient sampling technique was followed. Screening Questionnaire and MUEQ for CANS were used. Screening Questionnaire was designed to elicit information on inclusion and exclusion criteria. Those who qualified in the screening were administered MUEQ.

The MUEQ is a tool used to evaluate the nature and occurrence of CANS in computer-office workers and the impact of psychosocial and ergonomic aspects on work conditions (MUEQ). The translated versions of MUEQ-Brazilian-Portuguese, Arabic, and Sinhalese were studied and found to have satisfactory reliability and internal consistency.9,18-21 The MUEQ consists of 95 questions and needs approximately 20 min for completion. The questionnaire includes the sociodemographic characteristics (age, gender, and employment status), as well as six main domains assessing potential risk factors: that is, (1) workstation, (2) posture during work, (3) quality of break time, (4) job demands, (5) job control, and (6) social support.

**Statistical analysis**

Data were coded and entered into Microsoft Excel 2003 and analyzed using the statistical software Statistical Package for Social Sciences (SPSS for Windows, Version 16.0; SPSS Inc., Chicago, IL, USA). Descriptive and inferential statistical analysis was carried out. The prevalence of pain in different parts of the body and CANS was calculated in percentages. Univariate analysis was carried out to assess the association between CANS and contributing factors in various domains such as workstation and job demand. Chi-square test was used to test the significance of risk factors. Multiple logistic regression was used to characterize the relationship between CANS and independent variables (working hours, social support, posture, etc.) and to adjust for confounders. R^2 was used to check the goodness of fit. Independent variables were checked for multicollinearity using Cohen’s kappa statistics and few variables were removed from the model. P < 0.05 was considered statistically significant.

**Results**

In all, 206 professionals were screened for inclusion criteria and 181 participated in the study. The study group comprised 91 men (50.27%) and 90 women (49.72%) with mean ages of 30.12 ± 5.23 years and 30.69 ± 6.67 years, respectively. More than half (61.3%) of them had more than 5 years of work experience and almost two-third (62.8%) of the study population worked more than 5 days in a week. One-fourth (26.5%) of them worked more than 8 h in a day [Table 1].

The study found the prevalence of CANS in the study group to be 58.6%. Region-wise neck complaints topped the list followed

| Table 1: Sociodemographic characters |
|-------------------------------------|
| Characters                  | Frequency (N-181) | Percentage |
| Gender                      | Gender          | Frequency (N-181) | Percentage |
| Men                         | 91              | 50.2          |
| Women                       | 90              | 49.7          |
| Age in years                |                 |               |
| 20-29                       | 89              | 49.2          |
| 30-39                       | 71              | 39.2          |
| ≥40                         | 21              | 11.6          |
| Work experience             |                 |               |
| 1-3                         | 60              | 33.1          |
| 3-5                         | 51              | 28.2          |
| 5-8                         | 44              | 24.3          |
| >8                         | 26              | 14.4          |
| No. of working days/week    |                 |               |
| 5 days                      | 67              | 37.0          |
| >5 days                     | 114             | 62.8          |
| No. of working hours/day    |                 |               |
| 6-8                         | 133             | 73.4          |
| 9-10                        | 48              | 26.5          |
| No. of working hours with computer/day |       |
| 2-4                         | 18              | 9.9           |
| 5-7                         | 110             | 60.7          |
| 8-10                        | 53              | 29.45         |
by shoulder, wrist, hand, elbow, upper arm, and lower arm complaints as shown in Table 2. Women had higher prevalence of musculoskeletal complaints and statistically significant prevalence in upper and lower arm, wrist, and hand ($P < 0.05$).

Chairs that did not support the lower back and not having enough space to work at the desk were found to be significant contributory factors for CANS in workstation domain. It was also found that in body posture domain, those who were not maintaining a good work posture (52.8% vs 72.2%), performing repetitive tasks at work (66.7% vs 47.4%), keeping head and twisted (71.1% vs 54.4%) or in bent position (71.7% vs 52.1%), maintaining an awkward posture (73% vs 54.9%), and physically exhausted (76.5% vs 51.5%) suffered from CANS more than those who maintained ergonomically good posture and had less physical exhaustion. Those who had to do extra hours to complete a task had 2.4 [confidence interval (CI): 1.2–4.8] times higher odds of developing CANS than those who did not have to work extra hours. Similar observation was noted among those who work more than 8 h [Table 3].

Professionals who take sufficient breaks from work suffered from CANS less than who do not take breaks (46.9% vs 71.8%). Good physical environment such as fresh air inside the office and unwanted air were significantly associated with CANS. Professionals with friendly colleagues (54.3%) and supervisors (53.1%) reported less prevalence of CANS compared with those who did not have supportive colleagues (80%) and supervisors (78.9%).

A logistic regression was performed to ascertain the risk factors for CANS. The odds of developing CANS was 3.2 times higher (CI: 1.1–9.2) among those who did not have adequate workspace. Similarly those who maintain bad posture tend to develop CANS 2.3 (CI: 1.0–5.3) times more than those who maintain good posture. Not rotating job tasks also emerged as an independent risk factor for CANS [Table 3].

Discussion

In our study, the prevalence of CANS among professionals with occupational use of computers in Bangalore is 58.6%. It is closer to findings from a Dutch study by Eltayeb et al. which showed 55% prevalence rate. However, this prevalence is lower comparatively to other studies done in Sudan (70%), Sri Lanka (63.6%), and Greece (64%). The probable reason could be we had a stricter and exhaustive exclusion criteria, to satisfy the definition of CANS, for enrolling into the study, as well as in the final results we excluded those who said that their complaints were due to a previous accident.

The results of this study showed higher prevalence of neck and shoulder complaints in the study population compared with other complaints. The neck and shoulder complaints are followed by wrist and hand complaints. These findings are consistent with the earlier findings in various international studies as well as studies conducted in India using the same study tool.

Furthermore, women had higher prevalence rates of upper extremity musculoskeletal complaints – region-wise as well as overall, than men in our study which is similar to the study done by Bekiari et al. As per this study, possible explanations for this gender related difference could be that women tend to perform more repetitive work on average compared with men. Women are more exposed to additional stress from unpaid work such as housekeeping and child care. Women apparently do not always perform tasks with the same physical requirements or work organization as men.

Among the Indian studies, only one study done by Varun et al. in 2012 used the same study tool, that is, MUEQ to measure prevalence of CANS in healthcare professionals/students with computer usage. Overall prevalence in that study was 45% which was comparatively lower when compared with this study among computer professionals which was 58.6%. It is probably related to the differences in the intensity of occupational use of computers between the two study populations. Region-wise prevalence was similar with neck and shoulder complaints topping the list followed by wrist and hand complaints. Contributory factors identified in this study are consistent with other earlier international studies.

Earlier studies have shown that holding the head in a bent posture and working in the same posture for prolonged periods of time were both significantly associated with neck pain. In this study too, holding head in a bent posture was found to have

| Localization of complaints | Male n (%) | Female n (%) | Total, n (100%) | Chi square P |
|-----------------------------|------------|--------------|----------------|-------------|
| Neck complaints             | 46 (50.5%) | 49 (54.4%)   | 95             | 0.60*       |
| Shoulder complaints         | 34 (37.4%) | 44 (48.9%)   | 78             | 0.11*       |
| Upper arm complaints        | 9 (9.9%)   | 30 (33.3%)   | 39             | 0.00*       |
| Elbow complaints            | 18 (19.8%) | 33 (36.7%)   | 51             | 0.12*       |
| Lower arm complaints        | 8 (8.8%)   | 18 (20%)     | 26             | 0.03*       |
| Wrist complaints            | 28 (30.8%) | 39 (43.3%)   | 67             | 0.80        |
| Hand complaints             | 19 (20.9%) | 36 (40%)     | 55             | 0.005*      |
| Any upper extremity complaint (not due to previous accident) | 51 (56%) | 55 (61.1%) | 106 | 0.48 |

*Significant P
significant association with CANS and neck complaints topped the list in region-wise complaints.

In our study, there was no statistically significant association of CANS with age group, work pattern, work experience, number of work days/week, and number of working hours/day. We also found that working extra hours is associated with CANS in univariate analysis. These results were not corroborating with a prospective Dutch cohort study by Eltayeb et al. among 264 computer office workers with a follow-up period of 2 years. The differences in results could be due to inherent behavior/cultural differences of the study population, greater sample size of the Dutch study, and it being a prospective/longitudinal cohort study with a follow-up period of 2 years.

It is interesting to note that ergonomics of the workstation is the most common risk factor in all the domains. A study done in Brazil among computer office workers also demonstrated that those who reported more musculoskeletal disorders had worse ergonomic indexes. It also suggested that chair height, arm, and back rest are linked to improper upper limb postures leading to musculoskeletal disorders. Occupational Safety and Health

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**Table 3: Significant factors associated with CANS**

| Factors          | Category                  | Present | Absent | Total | P     | OR 95% CI |
|------------------|---------------------------|---------|--------|-------|-------|-----------|
| **Work Hours**   | <8                        | 84 (63.2%) | 49 (36.8%) | 133   | 0.03  | 1.1 (0.6-2.0) |
|                  | >8                        | 22 (45.8%) | 26 (54.2%) | 28    |       |           |
| **Workstation**  | Chair supports lower back | Yes     | 64 (52%)  | 59 (47.9%) | 123   | 0.009 | 0.4 (0.21-0.81) |
|                  |                           | No      | 42 (72.4%) | 16 (27.5%) | 58    |       |           |
|                  | Enough space to work      | Yes     | 73 (52.1%) | 67 (47.8%) | 140   | 0.001 | 0.26 (0.12-0.61) |
|                  |                           | No      | 33 (80%)  | 8 (19.5%) | 41    |       |           |
| **Body posture** | Good posture              | Yes     | 67 (52.8%) | 60 (47.2%) | 127   | 0.01  | 0.42 (0.21-0.85) |
|                  |                           | No      | 39 (72.2%) | 15 (27.8%) | 54    |       |           |
|                  | Awkward posture           | Yes     | 27 (73%)  | 10 (27%) | 37    | 0.04  | 2.2 (1.4-4.9)* |
|                  |                           | No      | 79 (54.9%) | 65 (45.1) | 144   |       |           |
|                  | Repetitive tasks           | Yes     | 70 (66.7%) | 35 (33.3%) | 105   | 0.009 | 2.2 (1.2-4.0)* |
|                  |                           | No      | 36 (47.4%) | 40 (52.6%) | 76    |       |           |
|                  | Physical exhaustion       | Yes     | 39 (76.5%) | 12 (23.5%) | 51    | 0.02  | 3.05 (1.4-6.5)* |
|                  |                           | No      | 67 (51.5%) | 63 (48.5%) | 130   |       |           |
|                  | Head bent                 | Yes     | 43 (71.7%) | 17 (28.3%) | 60    | 0.01  | 2.3 (1.1-4.5)* |
|                  |                           | No      | 63 (52.1%) | 58 (47.9%) | 121   |       |           |
|                  | Head twisted              | Yes     | 32 (71.1%) | 13 (28.9%) | 45    | 0.04  | 2.0 (0.9-4.2) |
|                  |                           | No      | 74 (54.4%) | 62 (45.6%) | 136   |       |           |
| **Job demand**   | Extra hours to complete tasks | Yes     | 40 (72.7%) | 15 (27.3%) | 55    | 0.01  | 2.4 (1.2-4.8)* |
|                  |                           | No      | 56 (52.4%) | 60 (47.6%) | 126   |       |           |
| **Break time**   | Alternate/change body posture | Yes     | 53 (51%)  | 51 (49%) | 104   | 0.01  | 0.4 (0.2-0.8) |
|                  |                           | No      | 53 (68.8%) | 24 (31.2%) | 77    |       |           |
|                  | Rotate job tasks          | Yes     | 33 (44.6) | 41 (55.4%) | 74    | 0.002 | 0.3 (0.2-0.6) |
|                  |                           | No      | 73 (68.2) | 34 (31.8%) | 107   |       |           |
|                  | Sufficient break time     | Yes     | 45 (46.9%) | 51 (53.1%) | 96    | 0.001 | 0.3 (0.18-0.64) |
|                  |                           | No      | 61 (71.8%) | 24 (28.2%) | 85    |       |           |
| **Work environment** | Unwanted air       | Yes     | 24 (82.8%) | 5 (17.2%) | 29    | 0.04  | 4 (1.4-11.3)* |
|                  |                           | No      | 82 (53.9%) | 70 (46.1%) | 152   |       |           |
|                  | Fresh air                 | Yes     | 44 (51.2%) | 42 (48.8%) | 86    | 0.05  | 0.5 (0.3-1.0) |
|                  |                           | No      | 62 (65.3%) | 33 (34.7%) | 95    |       |           |
| **Social support** | Can ask and enquire in one's work | Yes     | 78 (53.8%) | 67 (46.2%) | 145   | 0.009 | 0.3 (0.14-0.71) |
|                  |                           | No      | 28 (77.8%) | 8 (22.2%) | 36    |       |           |
|                  | Friendly colleagues       | Yes     | 82 (54.3%) | 69 (45.7%) | 151   | 0.009 | 0.2 (0.1-0.7) |
|                  |                           | No      | 24 (80%)  | 6 (20%) | 30    |       |           |
|                  | Friendly supervisors      | Yes     | 76 (53.1%) | 67 (46.9%) | 143   | 0.004 | 0.3 (0.1-0.7) |
|                  |                           | No      | 30 (78.9%) | 8 (21.1%) | 38    |       |           |

OR: Odds ratio; CI: Confidence interval. *Significant OR.
Table 4: Multiple logistic regression associated with CANS

| Factors                              | Category | B     | Adjusted OR | 95% CI       | P     |
|--------------------------------------|----------|-------|-------------|--------------|-------|
| Chair with back support             | Yes*     | -0.4  | 0.66        | 0.26 - 1.7   | 0.39  |
| Enough work space                   | Yes*     | 1.17  | 3.2         | 1.13 - 9.28  | 0.02**|
| Maintaining good posture             | No       | 0.87  | 2.3         | 1.0 - 5.3    | 0.03**|
| Performing repetitive tasks          | No*      | 0.4   | 1.4         | 0.7 - 3.0    | 0.28  |
| Physical exhaustion                  | Yes*     | 0.62  | 1.86        | 0.75 - 3.0   | 0.17  |
| Working extra hours                  | Yes      | 0.6   | 1.82        | 0.75 - 4.3   | 0.17  |
| Rotation of job tasks                | Yes      | 0.89  | 2.45        | 1.16 - 5.15  | 0.01**|
| Sufficient breaks                    | No*      | 0.61  | 1.85        | 0.91 - 3.7   | 0.08  |
| Friendly colleagues                  | Yes*     | 0.44  | 1.56        | 0.42 - 5.6   | 0.49  |
| Friendly supervisor                  | No       | 0.66  | 1.94        | 0.62 - 6.0   | 0.25  |

OR: Odds ratio; CI: Confidence interval. *Reference; **Significant P

Administration (OSHA) suggests making small adjustments to chair or back rest, stretching fingers, hands, arms, and torso, standing up and walking for few minutes periodically, and performing some tasks in standing position as healthy practices for computer professionals.\[24\]

We found that social support from colleagues and supervisors reduces the risk of CANS. According to Karasek’s Demand Control Model, having a job with high demands with no or little control over the decisions (e.g., fixed schedules, having a subordinate position) leads to an increase in stress and subsequent illness.\[28\] It is proposed that these outcomes can be modified if the person receives social support within the employment context.\[20\] This model has also been incorporated into musculoskeletal research and formulation guidelines.\[23\] But a systematic review concludes that employment-related support has little to no effect on risk of occurrence but a more notable effect on prognosis for those with back pain.\[28\] Professionals with less job demand and good social support by the supervisor will be probably possible to have more rotation of job tasks and reduce the risk of CANS. Perhaps, a long-term cohort study would be able to answer the question of causal relationship between social support and musculoskeletal pain.

CANS is often ignored most importantly by the physicians partly due to not being able to appreciate the importance of taking a careful detailed occupational history of exposure to a repetitive activity involving upper arms. Employment screening questions, incorporated into patients’ initial assessment, are an efficient means of identifying potential occupational causes of symptoms.\[17,29\] Initial management is conservative with medication, physiotherapy, or bracing which can be done by family physicians. Surgery is reserved for those refractory to conservative treatment.\[17\] Occupational health ought to be integrated into primary care systems as total separation of occupational and no occupational care is inefficient, counterproductive, and arbitrary.\[18\] Not only are primary care physicians or family physicians often the first to see patients with occupational diseases but also are more reliable compared with occupational physicians employed by industries, who can be biased toward the employer.\[10,32\] However, it has been reported that primary care physicians are poor in eliciting an occupational history and need additional education.\[31,34\] In India, physicians working in industrial settings are mostly primary care physicians, who have done a 3-month certificate course in occupational health as mandated by the Ministry of Labour, Government of India. Family physicians or primary care physicians as gatekeepers are in a unique position to provide not only with adequate curative or preventive care to these patients but also with rehabilitation, compensation, and insurance issues.\[29\] Hence, they can have a significant impact on the patient’s quality of life if they are alert to occupational cause of the illness and do comprehensive evaluation to elicit relationship between symptoms and occupation.\[30,36\]

Convenience sampling which we used may have limited the external validity of the study. Our samples were taken from small- to medium-sized companies, hence the prevalence and risk factors for CANS may vary in large IT companies. Many companies did not give permission due to lengthy questionnaire. Some companies gave conditional permission (only if we reveal the medical findings of the individual person to the management), hence was excluded.

Our study with a cross-sectional study with self-reporting of symptoms and there was no objective assessment done to ascertain the morbidity. We were able to do only in two locations as it was difficult to get permission from large-scale IT companies. We had used a long questionnaire which took almost 20 min per person. So our sample size was relatively lesser than studies done across the globe. However, we used a validated tool and assured anonymity of the participants to reduce under-reporting of the problem.

**Conclusion**

CANS is highly prevalent among computer professionals working in small- and medium-sized companies. The neck and shoulder complaints are reported more frequently than complaints in any of the other upper body regions. Furthermore, women had overall higher prevalence and significantly higher prevalence of upper limb complaints than men. Provision of adequate workspace and ergonomic designs of workstations are the modifiable risk factors which can be addressed by the employers to reduce the morbidity associated with CANS.

Employees could correct postures and improve work habits. These can be done by dissemination of knowledge among...
employees and strict legislation and guidelines by the government. These measures could be used as preventive, curative, as well as rehabilitative among those with CANS.

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There are no conflicts of interest.

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