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PERSONAL, BIOMECHANICAL AND PSYCHOSOCIAL RISK FACTORS FOR DE QUERVAIN'S DISEASE IN THE WORKING POPULATION

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ABSTRACT:

Objective: De Quervain's disease (DQD) is a significant cause of musculoskeletal pain among workers. The aim of this study was to assess the relative importance of personal and occupational risk factors for DQD in the working population.

Methods: A total of 3,710 workers of a French region were randomly included in the study between 2002 and 2005. A total of 50 cases of DQD were diagnosed by 83 trained occupational physicians performing a standardized physical examination, and individual factors and work exposure were assessed by a self-administered questionnaire. Statistical associations between DQD and individual and occupational factors were analyzed using logistic regression modeling.

Results: The prevalence rates of uni- or bilateral DQD for the whole, male and female working populations were 1.2% [95% CI, 0.9-1.6], 0.6% [0.3-0.9] and 2.1% [1.4-2.8], respectively.

Personal risk factors for DQD were mainly age (OR up to 3.6) and female gender (OR 5.6) and, to a lesser extent, associated carpal tunnel syndrome and/or flexor/extensor hand-wrist tendinitis (OR 10.6). Work-related factors were work pace dependent on technical organization (OR 2.4), repeated or sustained wrist bending in extreme posture (OR 2.5) and screwing movements (OR 3.7). No association was found with psychosocial factors.

Conclusion: Personal and work-related factors were associated with DQD in the working population, and wrist bending and screwing movements were the most significant of the work-related factors.

KEY WORDS:

De Quervain's disease, Personal factors, Physical exposure, Risk factors, Work

INTRODUCTION:

De Quervain's disease (DQD) is a stenosing tenosynovitis of the tendons and synovial sheaths of the abductor pollicis longus (APL) and the extensor pollici brevis (EPB) muscles which are involved in prehensile movements of the thumb. DQD causes pain and swelling near the base of the thumb during pinching, grasping and other movements of the thumb, and radial inclination of the wrist [1]. DQD is most often diagnosed in middle-aged women with a history of repetitive hand-wrist movements during work or hobbies, but sometimes occurs in young mothers carrying babies with the wrist held in flexion and ulnar deviation and the thumb in extension [2].

The work-relatedness of DQD has been recognized for many years in various occupations [3], but epidemiological information on this disorder in the working population is still scant. A wide range of prevalence of DQD (0.7% to 36%) has been reported in the working population, depending on the definition used and the populations involved [4-11]. An incidence of 0.6 per 1,000 person-years in men and 2.8 per 1,000 person-years in women has recently been reported in a large population of young US military personnel [12]. Although not caused only by work, DQD (1,415 cases in 2007) represents about 8% of the musculoskeletal disorders of the hand-wrist region receiving compensation each year in France, as observed in other industrialized countries [13].

Several combinations of individual factors, work factors and psychosocial factors related to hand-wrist musculoskeletal disorders (MSDs) have been identified [13-18], but few studies have specifically focused on DQD. The main work-related factors reported have been repetitive movements, forceful manual exertion, sustained awkward posture of the wrist, and combinations of these factors [13,14,16,18]. Most studies have involved highly exposed workers, and the relative importance of personal factors and work-related factors in DQD

remains to be agreed in the working population characterized by various levels of exposure to work-related constraints.

The surveillance program for MSDs implemented in the Pays de la Loire region by the National Institute for Public Health Surveillance since 2002 has allowed us to study the risk factors for DQD in workers exposed to various levels of work-related constraints [9,19]. The prevalence rate of DQD we reported for the first two years of the surveillance program was 0.7% [0.3-1.1] in men and 2.1% [1.2-2.9] in women [9]. Using the results of epidemiological surveillance over a three-year period, our aim in this study was to assess the incidence and relative importance of personal and occupational risk factors for DQD in a large sample of workers representative of the working population of the region.

METHODS:

Study population and design

Population: This cross-sectional study was conducted in the Loire Valley region of West-Central France. The economic structure of the region (5% of the French working population) is diversified and similar to that of most French regions.

All French salaried workers, including temporary and part-time workers, undergo a mandatory annual health examination by a qualified occupational physician (OP) in charge of the medical surveillance of a group of companies. A total of 83 OPs, representative of the region's OPs, participated in the study. Subjects were randomly selected from workers undergoing a mandatory regularly-scheduled annual health examination between April, 2002 and April, 2005. All OPs were trained by the investigators to include workers randomly and to perform a standardized physical examination.

The study population comprised 3,710 workers (2,161 men (58%), 1,549 women (42%), mean age = 38.7, sd = 10.4 years) representing about 3.4‰ of the regional workforce. Comparison of their socio-economic status with the last available French census (1999) (http://www.insee.fr) showed no major differences for either gender. Subjects worked mainly in the service industries (59%), the meat and manufacturing industries (34%), and more rarely in the construction (6%) and agriculture (1.5%) sectors. Overall, the distribution of occupations was close to that of the regional workforce, except for the rare occupations not surveyed by OPs (e.g., shopkeepers and independent workers). Men were mainly skilled and unskilled blue collar workers (56%), intermediate occupations and technicians (25%), and managers and professionals (10%). Most women were low grade white collar workers (52%), skilled and unskilled blue collar workers (24%), and intermediate occupations and technicians (19%). Length of service in the current job was high for the majority of workers, whatever the gender. Length of service was more than ten years in 55% of cases, more than two years in 81% and more than one year in 92%.

Outcomes: The presence of non-specific upper-extremity pain during the last twelve months and the preceding seven days was identified using the "Nordic-style" questionnaire [9]. A mannequin was used to denote the hand-wrist region. In cases of hand-wrist symptoms occurring during the past 12 months, a physical examination was performed by the physician using a standardized clinical procedure that strictly applied the methodology and clinical tests of the 'European consensus criteria document' for DQD and the five other specific upper extremity MSDs (UE-MSDs) surveyed (rotator cuff syndrome, lateral epicondylitis, ulnar tunnel syndrome, carpal tunnel syndrome, and flexor-extensor peritendinitis or tenosynovitis of the forearm-wrist region) [20]. (See Roquelaure *et al.* [21] for details). DQD was diagnosed if (i) there was intermittent pain or tenderness localised over the radial side of the wrist,

possibly radiating proximally to the forearm or distally to the thumb, and present currently or for at least 4 days in the preceding 7 days; and (ii) Finkelstein's test was positive, with distinct right/left difference. This test was performed according the recommendations of Sluiter *et al.* [20] with the patient sitting with the forearm resting on a table in a pronated position and the wrist extended at about 20°. The fist was clenched with the thumb tucked in the fingers. One of the OP's hands stabilised the distal forearm from the ulnar side and the other was placed around the fist from the radial side and gently performed ulnar abduction.

Potential risk factors: The potential risk factors included personal factors and medical history, work history and exposure to physical, psychosocial and organizational work factors (Table 1).

Personal factors and medical history: details of weight, height, associated CTS and/or flexor/extensor hand-wrist tendinitis, diabetes mellitus, and thyroid disorders were collected during the physical examination.

Work history and occupational risk factors: exposure was assessed with a self-administered questionnaire including information on the characteristics of the job and tasks, work organization and the main potential risk factors for upper limb MSDs. Biomechanical risk factors for DQD were defined and quantified according to the 'European consensus criteria document' [20], except for physical workload which was assessed using the Rating Perceived Exertion Borg scale (20-RPE) graduated from 6 ('very, very light') to 20 ('maximal exertion'). Postures of the hand and pinching movements were assessed using picture forms to facilitate workers' understanding. Response categories were presented on a 4-level Likert-type scale, as follows: never or practically never, rarely (less than 2 hours per day), often (2 to 4 hours per day) and always (more than 4 hours per day). Information on the work organization, time schedule, and daily job rotation was collected. Exposure to stress at work

was appraised with reference to the 'Demand-Control-Support model' using the validated French version of the 'Job Content Questionnaire' [22]. The questionnaires were filled out by workers just before the medical examination and checked by the OPs at the beginning of the medical examination. The response rate to all questions was above 97%.

Statistical methods

The outcome was defined by subject, and thus bilateral cases of DQD counted as one disorder, not two. The list of independent variables considered in the analyses comprised variables known or suspected to be potential risk factors for hand-wrist disorders on the basis of epidemiological and ergonomic studies (Table 1) [14-17,23,24]. Analyses were performed for the whole sample of workers using binary logistic regression modeling, which followed a three-level process consisting of univariate models (stage 1), group multivariate models (stage 2) and final multivariate model (stage 3). All models included age and gender as possible confounders.

- Stage 1: Univariate analyses were performed with each of the potential explanatory variables as independent variables and DQD as dependent variable. Non-significant variables ($P > 0.20$) were excluded from further analyses.
- Stage 2: The independent variables not excluded in stage 1 were grouped into the five groups of potential determinants (see Table 1), i.e. personal factors and medical history, work history, factors related to work organization, postural and biomechanical constraints, psychosocial factors at work. Backward multivariate logistic regression models were then performed for each of the five groups of variables (except age and (if appropriate) gender, which were forced into all models). Non-significant variables ($P > 0.10$) after this stage were excluded from further analyses.

- Stage 3. Final multivariate logistic regression analyses were performed using all remaining variables after stages 1 and 2. If a subject was missing for any variables included in the final model for the whole population, that subject was excluded from the analysis. Non-significant variables ($P > 0.05$) were excluded

All analyses were performed with the SAS statistical software package (version 9.2: SAS Institute, Inc., Cary, NC, US).

RESULTS:

A total of 50 cases of DQD were diagnosed in 45 workers (32 women, 13 men). The right hand was involved in 23 cases, the left hand in 17 cases and both in 5 cases. The prevalence rates of uni- or bilateral DQD for the whole, male and female working populations were 1.2% [95% CI, 0.9-1.6], 0.6% [0.3-0.9] and 2.1% [1.4-2.8], respectively. Higher prevalence was observed in skilled (0.8% of men and 4.5% of women) and unskilled (1.1% of men and 3.4% of women) blue collar workers.

DQD was often associated with carpal tunnel syndrome (CTS) (33 % of cases) or rotator cuff syndrome (29%), and more rarely with lateral epicondylitis (7%), ulnar tunnel syndrome (4%) or flexor-extensor peritendinitis/tenosynovitis of the forearm-wrist region (2%).

As shown in Table 2, multivariate analyses showed an increased risk of DQD with age, especially after 55 years (OR 3.6). The association between DQD and length of service in the current job did not remain statistically significant in the final logistic model. Among the personal factors studied, female gender (OR 5.6) and (even more) coexistent CTS and/or flexor/extensor hand-wrist tendinitis (OR 10.6) were strongly associated with DQD after adjustment for other potential confounding factors.

Among the factors related to the work organization studied, work pace dependent on the technical organization was highlighted in the final model (OR 2.4), as were two work-related

biomechanical factors: repeated or sustained wrist bending in extreme postures for more than 2 hours per day (OR 2.5) and repeated twisting or screwing movements for more than 2 hours per day (OR 3.7). No significant relationships were observed for pinching, use of vibrating hand tools, computer or keyboard. High repetitiveness of the task, high physical demand and exposure to cold were not related to DQD. No significant association was found with psychosocial factors of stress at work.

DISCUSSION:

The prevalence of the De Quervain's disease was 1.2% in this large representative sample of the working population, and higher in blue collar workers. The study showed the multifactorial origin of DQD and highlighted a limited number of personal and work-related risk factors.

The prevalence of DQD observed in this working population was close to that estimated in the British general population of working age (0.5% of men and 1.3% of women) [25]. However, our estimates were lower than that reported in highly exposed blue collar workers in automotive plants [4,8,11] and the meat-processing and manufacturing industries [7,10,15]. Among the potential personal factors studied, female gender was the main factor associated with DQD in our population. This is consistent with the epidemiological literature [4,12,13,26,27]. The higher risk of DQD in women could reflect both biological predispositions (sex- effect) and overexposure to biomechanical repetitive work-related constraints (gender- effect) [28]. Previous results regarding all UE-MSDs [21] suggest that the gender difference more probably reflects differences in exposure to constraints at work than physiological differences (e.g., body size). In most cases, women are more often exposed to

tasks requiring dexterity and rapid and repetitive movements of the thumb and fingers because of the gender division of work [13].

Advancing age increased the risk of DQD, which is consistent with the medical literature reporting 'normal' degenerative changes in ageing tendons and higher risk of DQD in workers over 40 years of age [12,15,29]. However, age seemed to play a lesser role in DQD than in other UE-MSDs in this working population, in particular rotator cuff syndrome [21]. No clear association was found between length of service and DQD, but age and length of service were highly correlated, making it difficult to disentangle the role of age from the effects of cumulative exposure to occupational hazards in the interpretation of our results.

CTS and tenosynovitis of the wrist overlapped extensively with De Quervain's disease (OR 10.6), which confirms clinical experience and epidemiological findings [8,25,30]. Contrary to some studies [12,15], no association was found with abnormal weight and diabetes mellitus. The low severity of the cases of DQD compared to cases recruited in orthopedic or rheumatologic clinics could explain this result, as could the lack of statistical power of the study.

Our study shows a strong and consistent association between DQD and sustained or repeated wrist bending and twisting. This confirms results for hand-wrist tendinitis observed in workers highly exposed to wrist flexion / extension [16], pronosupination [13] and, more generally, sustained or repeated postures of the hand and wrist [13,25,31,32]. The influence of postural factors on the risk of DQD seems to be higher and more significant for DQD than for the other UE-MSDs in this working population [21]. However, we cannot exclude the possibility that some workers suffering from DQD overrated their exposure to awkward working postures [33]. Exposure to work pace dependent on the technical organization, which could be assimilated as a measure of the repetitiveness of the task, increased the risk of DQD. This agrees with previous studies on hand-wrist tendonitis [12,13,16,31,34,35]. The

multifactorial nature of disorders involving several biomechanical and organizational factors is coherent with the literature reporting higher risk of hand-wrist tendinitis for combined exposure to work-related risk factors [13,32]. Contrary to some studies, no association was found for the physical demands of the task, forceful exertion [12,13,31,34,35]. or exposure to hand-wrist vibrations [31].

Using the Demand-Control-Support model of stress at work, no significant relationship was found for stress, contrary to the findings in the same population for UE-MSDs overall [21] or rotator cuff syndrome in particular. Consequently, this could not be explained by the methodology used, except for a lack of statistical power due to the small number of cases of DQD diagnosed. The results in the literature are inconsistent, since some studies of wrist tendinitis reported an association with psychosocial factors, such as low social support or psychosocial stress [34], and others not [17,24].

The large sample of workers was characterized by wide variations in activity sectors and occupations, representing a broad range of both physical and mental occupational tasks. Its good representativeness in relation to the regional workforce allows greater generalization of the results than epidemiological studies conducted in selected occupational populations. Few workers failed to participate but, due to the cross-sectional design of the study, a “healthy worker effect” could have occurred and may have caused an underestimation of the estimates of risk. Outcomes were assessed clinically by trained physicians using a rigorous physical examination, including standardized provocation tests, and allowing more accurate diagnosis of DQD than the questionnaire. Finkelstein’s test is widely accepted and used by clinicians for the diagnosis of DQD [20]. However, it lacks specificity and may be positive in cases of osteoarthritis of the wrist or first carpometaphalangeal joint and flexor/extensor hand-wrist tendonitis [36], which frequently overlap with DQD [8,25]. We cannot therefore exclude the

possibility that some cases diagnosed as DQD were symptomatic of osteoarthritis or flexor/extensor hand-wrist tendinitis in the absence of imaging of the wrist.

In contrast to several studies, our survey allowed assessment of the risk factors for specific MSDs defined by objective criteria in a diversified working population. Length of service for most workers was longer than the previous 12-month period chosen for the assessment of work exposure, and this reduces exposure classification errors. The main personal and occupational potential risk factors for DQD described in the literature were taken into account. While the potential determinants of DQD are numerous, few studies involving workers have taken personal, physical and psychosocial factors into account together. Non-work activity, such as housework, leisure and sports, were not assessed although they may increase the risk of DQD. Although residual confounding factors are always possible, we believe that we had information on the most important confounders. As much as possible, standardized and validated instruments were used to reduce exposure classification errors. For example, wrist postures were presented in picture form to facilitate workers' understanding and increase the validity of posture self-assessment. The recall period of the last 12 months chosen limits recall errors in self-reported exposure [37]. The most serious drawback to exposure assessment in this study was that occupational risk factors were assessed through a self-administered questionnaire [33]. We cannot exclude the possibility that self-reporting exposure may have biased risk estimates, since workers experiencing musculoskeletal pain may overrate their exposure levels. However, under-rating was also possible, especially for workers who moved to lighter work because of recurrent symptoms.

In conclusion, the study showed that personal and work-related factors were strongly associated with clinically-diagnosed DQD. Among the work-related factors for DQD, the wrist had a more significant role than other physical factors. Because of the multifactorial

nature of the disorder, the importance of work exposure to physical factors contributing to DQD is not diminished by the relative impact of personal factors. Depending on the intensity, frequency and duration of workplace exposure, personal factors may have a greater or less important role. Moreover, as for most individual factors, age is not modifiable compared to work-related factors. Mechanical exposure should therefore be an important target of strategies for the prevention of DQD in the working population.

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Competing interest: none

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