Parental attachment, premorbid personality, and mental health in young males with hyperventilation syndrome

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Abstract

The aim of the study was to examine the predisposing and precipitating factors in the development of hyperventilation syndrome in males during military training in Taiwan. The participants included 110 young males who visited the emergency room of a teaching hospital in southern Taiwan because of an episode of acute hyperventilation during military training. Another 53 males, who had the same military training, and who did not experience hyperventilation or any psychiatric symptoms, were recruited as the control group. The risk of hyperventilation syndrome was increased by the following factors: greater neuroticism, less extraversion, parental overprotection, and less parental caring. A final parsimonious structural equation model showed a cause–effect relationship between the direct effects of maternal overprotection and introversion and the individual’s neurotic characteristics, which contributed to the individual’s current mental health status and the development of hyperventilation syndrome. Military training could be a precipitating factor in the development of hyperventilation syndrome in young males. The elucidation of these factors may contribute to the understanding and treatment of hyperventilation syndrome. The determination of competing risk factors and mediating effects in males with hyperventilation syndrome should be considered in future studies.

Keywords: Hyperventilation syndrome; Premorbid personality; Parenting attachment

1. Introduction

Hyperventilation syndrome is a common, frightening, but easily treated disorder. It is believed that psychological factors play important roles in producing hyperventilation syndrome (Cowley and Roy-Byrne, 1987). The condition refers to various somatic and psychological symptoms as an apparent consequence of episodes of hyperventilation with no known organic basis. Hyperventilation syndrome is defined as breathing in excess of metabolic needs, which acutely leads to a reduction in the level of arterial pCO₂ (hypocapnia) (Folgering, 1999; Wilhelm et al., 2001). Although the etiology of...
hyperventilation syndrome is disputed, most psychiatrists view it as one of the concomitant physiological effects of anxiety, and they place it at the somatic end of the somatic-psychiatric anxiety continuum.

Some studies have reported that hyperventilation syndrome might be caused by anxiety, depression and related symptoms (Preffer, 1978; Garssen, 1980; Clark and Hemsley, 1982; Brodtkorb, 1990). In particular, hyperventilation syndrome has received much attention in panic disorder research. Panic disorder is characterized by recurrent unexpected panic attacks about which there is persistent concern—typically about having additional attacks and about the somatic or psychological implications of attacks. Thus, in its current conceptualization, panic disorder is a syndrome that at its core includes both disordered physiology and persistent apprehension about the occurrence symptoms. Before the diagnostic category of panic disorder became accepted, hyperventilation syndrome had been described, and a symptomatic overlap between the two entities was apparent (Ley, 1985; Hornsveld and Garssen, 1997). Hence, panic disorder is sometimes difficult to diagnose in an individual with hyperventilation syndrome without long-term follow-up (Herman et al., 1981).

Hyperventilation syndrome has been described as usually being accompanied by mental health problems, but the potential risk of the pathogenesis of hyperventilation syndrome is unclear. In several studies, researchers have found that personality traits, such as neurotic and extraverted characteristics (Duggan et al., 1998; Maslach et al., 2001), and childhood experiences, such as paternal caring and maternal protection (Stein et al., 2000; Weinich et al., 1996), are risk factors for the development of mental health problems.

According to Russek and Schwartz’s (1997) report, parental care and love may have important regulatory and predictive effects on an individual’s biological wellness and mental health (Russek, 1998). Portegijs (1996) found that somatization was specifically related to a childhood history of parental deprivation. In their study, Xia and Qian (2001) found that many psychosomatic symptoms, as well as lower indexes of general mental health, were significantly related to parental features, including higher levels of rejection and denial and a tendency for punishment, overprotection, and overinvolvement.

Lowry (1967) believed that hyperventilation syndrome was not indicative of any particular personality type. However, Drunkenmollke (1973) found abnormally high scores on the hysteria, depression, and hypochondriasis scales in 19 of 21 patients tested with an abbreviated form of the Minnesota Multiphasic Personality Inventory (MMPI). Brodtkorb (1990) found high scores on the hysteria, depression, hypochondriasis, paranoia, psychasthenia, and schizophrenia scales of the MMPI in patients with hyperventilation syndrome. In addition, Clark and Hemsley (1982) found that neuroticism, as assessed with the Eysenck Personality Questionnaire (EPQ), was significantly correlated with affective symptoms after a brief period of voluntary hyperventilation. Other studies revealed the presence of emotional maladjustment and phobic personality traits in people with hyperventilation syndrome (Preffer, 1978; Garssen, 1980).

In addition, hyperventilation syndrome is an important issue in military medicine. In 1871, DaCosta first mentioned a cluster of symptoms similar to hyperventilation syndrome, which together were called “irritable heart”, in about 300 military personnel involved in the American Civil War. In World War I, some soldiers had symptoms of palpitations, chest pain, and difficulty in breathing, which Lewis (1919, 1940) called soldier’s heart and effort syndrome. Because the Taiwanese military is staffed through conscription, most young males above 19 years old are required by law to serve in the armed forces. The lifestyle of the troops is different from life outside the military; every soldier experiences great physical and psychological stress. Lung et al. (2002) found that parenting style and neurotic personality traits could be important in the development of adjustment problems, and even hyperventilation syndrome.

In brief, hyperventilation syndrome seems to accompany mental syndromes, even panic disorder. One study found a slow physiological and symptomatic recovery from hyperventilation syndrome in panic disorder (Wilhelm et al., 2001). Hence, the present study was designed to determine the roles of predisposing factors such as parental attachment, mediating factors such as premorbid personality coping styles, and precipitating factors such as mental health in males with hyperventilation syndrome during military training. The cause–effect relationship of predisposing, mediating, and precipitating factors among young males with hyperventilation syndrome was also taken into account in this study.

2. Methods

2.1. Participants

Approval was first obtained from the institutional review board (IRB) at a teaching hospital in southern
Taiwan. All participants also gave detailed informed consent before completing the questionnaires.

This study population consisted of 110 males undergoing military training (mean age=21 years, S.D.=1.96), who visited the emergency room due to an attack of acute hyperventilation. All participants had arterial blood withdrawn for \( p \text{CO}_2 \) examination. The diagnosis of acute hyperventilation was made on clinical grounds by the senior internist of the emergency department, on the basis of history, observation, physical examination and necessary biochemistry testing. Once organic medical diseases had been ruled out, psychiatrists took over the patient’s care. All participants lived in the hospital for at least 1 week to screen for other psychiatric diagnoses. They were interviewed by a senior psychiatrist with the Chinese versions of the Structured Clinical Interview for DSM-III-R (SCID; Chen and Ku, 1993). No participant with any clinical evidence of physical illness, panic disorder, phobia disorder or other psychiatric disorders included in the DSM-III-R (American Psychiatric Association, 1987) was referred for study.

The control group included 53 healthy volunteers (mean age=22 years, S.D.=1.36) who came from the same unit as the hyperventilation individuals. All controls were interviewed by a senior psychiatrist with the Chinese version of SCID for DSM-III-R, and were verified to have never experienced hyperventilation syndrome, or physical or psychiatric illness.

2.2. Instruments

A self-report questionnaire included demographic information, the Chinese versions of the Parental Bonding Instrument (PBI) and the Eysenck Personality Questionnaire (EPQ), and the Chinese Health Questionnaire (CHQ). The demographic data included the patient’s age, marital status, and education, and, in the study group, the symptoms of hyperventilation.

2.2.1. Parental bonding instrument

Parker, Tupling and Brown developed the PBI in 1979. It is a self-reported measure of fundamental parental dimensions of care and protection. The Chinese version of the PBI was modified by Shu et al. (1999). The PBI was designed as a refined self-report measure of the fundamental dimensions of care and protection for each parent. The questionnaire instructed subjects to rate “how like” they judged each of the 25 items as a description of their mother’s and (separately) their father’s behaviors toward them during the first 16 years of life, with rating options being “very like”, “moderately like”, “moderately unlike” and “very unlike”, generating scores of 3, 2, 1, 0, respectively. It was composed of 12 care dimensions and 13 protection dimensions. Cronbach’s alpha value was 0.65–0.73, and test-retest reliability was 0.66–0.88 (Shu et al., 1999).

2.2.2. Eysenck personality questionnaire

The EPQ, developed by Eysenck and Eysenck (1975), consists of four subscales of psychoticism, extraversion, neuroticism, and lying. In 1994, the Chinese version was established by Lu. It was composed of two dimensions (14 items for extraversion, and 11 items for neuroticism). Higher scores tended to reveal higher levels of extraversion and neuroticism. Cronbach’s alpha value of 0.90 and good validity were demonstrated by Lu (1994).

2.2.3. Chinese health questionnaire

Cheng and Williams (1986) designed the CHQ. It was derived from a Chinese translation of the General Health Questionnaire (Goldberg, 1978; Goldberg and Williams, 1988) with the addition of culturally relevant items into a primary item pool. This item pool was then treated with discriminant function analysis to select a subset of 12 items. A simple scoring method of 0-0-1-1, with rating options being “not at all”, “about as usual”, “more than usual” and “strong feeling”, was applied to the CHQ. Firstly, the level of psychopathology was calculated using a global score. The potential cases (CHQ+) and non-cases (CHQ-) were categorized by the optimum cutoff point (the best compromise between high sensitivity and a low false–positive rate), which was 3/4 from the Receiver Operating Characteristic (ROC) curves (Chong and Wilkinson, 1989). The internal consistency of the CHQ was indicated by alpha coefficients of 0.79, as demonstrated by Cheng et al. (1999).

2.3. Statistical analysis

Data were analyzed using the SPSS 10.0 for Windows software package (SPSS, Chicago, IL), and structural equation modeling with the AMOS 5.0 statistical software package. All variables were analyzed using the primary descriptive statistic. An unpaired t test was used for comparison between groups for continuous variables. Logistic regression analysis was used to identify independent risk factors in terms of demographic characteristics, mental health, two dimensions of personality characteristics, and parental bonding for the predictive model of hyperventilation. Moreover, structural equation modeling techniques made use of all
the information that was provided by the regression techniques and path analyses, and allowed for the consideration of additional information that might help disentangle the possible impact of various predictors.

3. Results

3.1. Socio-demographic characteristics

The mean age of the males with hyperventilation syndrome was 21.09 years (S.D. =1.96), and the mean age of the control group was 21.79 years (S.D. =1.36) \((t=2.35, P=0.02)\). The mean educational level of the males with hyperventilation syndrome was 12.55 years (S.D. =2.09), compared with 12.98 years (S.D. =2.14) in the control group \((t_{163}=1.24, P=0.22)\). Fifty-seven of 110 participants in the case group (51.8%) had their first attack of hyperventilation syndrome during military training.

3.2. Analysis of parental attachment, personality characteristics, and mental health

The mean PBI score for paternal care among the males with hyperventilation syndrome was 19.31 (S.D. =6.32), compared with 22.11 (S.D. =4.89) in the control group. The difference in paternal care between the two groups was statistically significant \((t_{163}=2.84, P=0.01)\). The mean score for maternal care in the case group was 22.93 (S.D. =5.28), compared with 25.34 (S.D. =4.83) in the control group. The difference in maternal care between the two groups was also statistically significant \((t_{163}=2.81, P=0.01)\) (Table 1).

For the parental protection part of the PBI, the mean score for the males with hyperventilation syndrome was 14.41 (S.D. =5.29) compared with 11.57 (S.D. =5.21) in the control group. The difference in paternal protection between the two groups was statistically significant \((t_{163}=3.23, P=0.00)\). The mean score for maternal protection in the case group was 14.76 (S.D. =6.54) compared with 11.30 (S.D. =5.41) in the control group. The difference in maternal protection between the two groups was also statistically significant \((t_{163}=3.34, P=0.00)\). Table 1 presents the results.

The mean extraversion score for the males with hyperventilation syndrome, as assessed by the EPQ, was 6.18 (S.D. =4.08), compared with 9.42 (S.D. =3.31) for the control group. The difference in the personality trait of extraversion between the two groups was statistically significant \((t_{163}=5.03, P=0.00)\). The mean score for neuroticism in the males with hyperventilation syndrome, as determined with the EPQ, was 7.77 (S.D. =2.98) compared with 2.53 (S.D. =2.44) in the control group. The difference in the personality trait of neuroticism between the two groups was also statistically significant \((t_{163}=-11.14, P=0.00)\) (Table 1).

The mean CHQ score among males with hyperventilation syndrome was 6.51 (S.D. =3.55) compared with 0.75 (S.D. =1.45) in the control group. The difference in the CHQ scores between the two groups was statistically significant \((t_{163}=-14.65, P=0.00)\). Table 1 presents the results.

3.3. Logistic regression analysis

Logistic regression analysis was used to compare the two groups on all related factors, such as education, age, mental health status, personality traits, and parental bonding. The difference in the neurotic personality characteristics and mental health status of the males with hyperventilation syndrome and of those in the control

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Sig</th>
<th>R</th>
<th>Exp(B)</th>
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<tbody>
<tr>
<td>CHQ</td>
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<td>0.00</td>
<td>0.16</td>
<td>1.84</td>
</tr>
<tr>
<td>Neuroticism</td>
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<td>0.01</td>
<td>0.10</td>
<td>1.30</td>
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<tr>
<td>Constant</td>
<td>-2.18</td>
<td>0.00</td>
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CHQ: Chinese Health Questionnaire.
Dummy variables of the groups – 0: control group; 1: participants with hyperventilation syndrome.
group were statistically significant ($P<0.05$). The case group showed worse results in their mental health and greater neuroticism than the control group (see Table 2).

3.4. Structural equation modeling

Structural equation modeling showed that $P$ values were greater than 0.05 ($P=0.473$), and goodness-of-fit models (GFI=0.991) and adjusted goodness-of-fit models (AGFI=0.968) were greater than 0.9; hence, the null model corresponded to the real structure. Fig. 1 represents the direct and indirect effects of maternal protection, neuroticism, extraversion, and mental health in the development of hyperventilation syndrome.

The results of this study indicated that maternal protection had a positive direct effect on neuroticism ($\beta=0.27$, $P=10^{-3}$). Extraverted characteristics had a negative direct effect on both neurotic characteristics ($\beta=-0.44$, $P=10^{-8}$) and mental health ($\beta=-0.14$, $P=0.013$). Neurosis had a positive direct effect on mental health ($\beta=0.68$, $P=10^{-10}$) and a positive direct effect on the males with hyperventilation syndrome ($\beta=0.36$, $P=10^{-4}$). Individual mental health had a positive direct effect on the males with hyperventilation syndrome ($\beta=0.39$, $P=10^{-5}$).

On the other hand, maternal protection had a positive indirect effect on mental health in terms of neuroticism ($\beta=0.18$). That is, the individual’s mental health was worse with an overprotective mother. In addition, maternal protection had a positive indirect effect on the development of hyperventilation syndrome in terms of neuroticism ($\beta=0.17$). In other words, the individual with an overprotective mother tended to develop hyperventilation syndrome easier than those without an overprotective mother. Individual personality characteristics of extraversion had a negative indirect effect on the development of hyperventilation syndrome in terms of mental health ($\beta=-0.34$). That is, individuals with a lower degree of extraversion tended to develop hyperventilation syndrome easier than those with a higher degree of extraversion.

In this structural model, the variances of neuroticism and mental health were 27% and 57%, respectively. The results accounted for 50% of the variance for the differences between males with hyperventilation syndrome and the controls.

4. Discussion

As hypothesized in Section 1, during the transition to military training, individuals might be particularly vulnerable to the development of hyperventilation syndrome. A total 57 of 110 young males in this study had their first attack of hyperventilation syndrome during military training. Also, the study found that the development of hyperventilation syndrome is associated with early parental attachment and premorbid personality characteristics in young males.

As in previous studies, parental attachment was associated with physiological indices of stress reactivity (Preuessner et al., 2004). The parental rearing style experienced by the males with hyperventilation syndrome was significantly different from that experienced by the control group. Parents of individuals with hyperventilation syndrome tended to be more protective and less caring, especially in terms of maternal protection. These results are similar to those of previous studies (Portegijs, 1996; Russek and Schwartz, 1997; Russek, 1998; Xia and Qian, 2001) in which individuals who had physical and mental problems also experienced more negative parental child-rearing approaches.

Moreover, the findings of this study indicated that the males with hyperventilation syndrome tended toward more neuroticism and introversion. This finding is similar to those of previous studies (Preffer, 1978; Garssen, 1980; Clark and Hemsley, 1982; Brodtkorb, 1990), which indicated that both maladjustment and
hyperventilation syndrome are linked to the personality characteristic of neuroticism. Neurotic individuals are emotionally unstable and prone to psychological distress, anxiety, depression, and maladaptive behaviors. In addition, the results of this study also showed that the mental health status of males with hyperventilation syndrome was worse than that of the individuals in the control group.

Logistic regression analysis demonstrated that the personality characteristic of neuroticism and the mental health status are the main factors contributing to the development of hyperventilation syndrome during military training. The results showed that males with a higher level of neuroticism tended to develop hyperventilation syndrome 1.3 times more often than those with a lower level of neuroticism (odds ratio of a higher level of neuroticism vs. a lower level of neuroticism = 1.30:1). Males with worse mental health tended to have 1.8 times the risk of relapse of hyperventilation syndrome (odds ratio of a higher level of neuroticism versus a lower level of neuroticism = 1.84:1).

However, regarding the limitations of regression, the latent factors of pathogenesis and path in hyperventilation syndrome might have been not estimated in this regression analysis. Structural equation modeling revealed that maternal protection and extraverted characteristics directly affected neurotic characteristics, and indirectly contributed to the development of hyperventilation syndrome. Hence, maternal overprotection and introversion might have contributed to the higher level of neurotic characteristics among the males. Moreover, maternal overprotection and introversion might also be mediated by neurotic characteristics in contributing to hyperventilation syndrome. The neurotic characteristic had a simultaneously positive, direct effect on the males’ mental health and development of hyperventilation syndrome.

As seen in previous studies, personality can be considered to have an effect on primary and secondary appraisal, that is, personality can shape one’s appraisal of the event itself and the coping strategies that may be preferred (Scheier and Bridges, 1995; Kiecolt-Glaser et al., 2002). The implication of this is that certain personality types may choose more adaptive methods of coping with the event, and thus have a better outcome. The results of structural equation modeling showed that a coping style based on extraverted and neurotic personality characteristics may predispose individuals toward the development of disease.

Structural equation modeling can be used to simultaneously provide a natural course regarding the path effect, the current effect, a regression, and concurrent validity. In this study, structural equation modeling in goodness-of-fit models (GFI) was more than 0.9 (GFI = 0.991), and the P value was more than 0.05 (P = 0.473). There was a 50% variance for the difference between males with and without hyperventilation syndrome. This means this null model corresponded to the conceptual construct. Hence, the final parsimonious structural equation modeling of this study could present the pathway of risk factors in males with hyperventilation syndrome during the period of military training. It also may help in the early detection and treatment of males with hyperventilation syndrome.

In addition, all males in this study with hyperventilation syndrome had a maladjustment problem during military training. As in previous studies, the results showed that maternal protection (Stein et al., 2000; Weich et al., 1996) and the personality trait of neuroticism (Duggan et al., 1998; Maslach et al., 2001) were the predictive risk factors for adjustment dysfunction. Maternal overprotection and neurotic and extraverted characteristics would also impact mental health status, and increase the risk of a maladjustment problem (Lung et al., 2002) or hyperventilation syndrome. However, whether the mental health problem of the males was based on adjustment disorder or due to hyperventilation syndrome, has been debated. The hyperventilation syndrome of the males may possibly be a part of the maladjustment during military training. On the other hand, the results of this study were contrary to those of males with homosexuality related to paternal attachment (Shieh and Lung, 2005), and as a result of the oedipal conflict (de Kuyper, 1993); hyperventilation syndrome associated with maternal attachment might result from the pre-oedipal conflict.

Interestingly, the results of this study showed that hyperventilation is a syndrome with more psychosocial problems and without other psychiatric disorders, especially panic disorder, which combines with comorbid disorders, such as major depression, anxiety disorder (Bovasso and Eaton, 1999; Goodwin and Hamilton, 2002), and even suicide (Cox et al., 1994; Friedman et al., 1999; Hornig and McNally, 1995) or gastrointestinal complaints (Walker et al., 1992). However, participants with psychiatric disorders did not appear in this present study, possibly because those with physical or psychiatric disorders were screened out by the military before they entered the training. Another comparison group of individuals with a psychiatric diagnosis, such as adjustment disorder without hyperventilation syndrome, should be considered for inclusion in a future study. In addition, the
issue of psychodynamics should be provided as a reference in clinical treatment, and will be considered in future studies.

In conclusion, this study, using structural equation modeling, provided considerable evidence regarding maternal overprotection and premorbid personality as possible factors leading to vulnerability for the development of hyperventilation syndrome during the period of military training. Hence, the results of the present study can be helpful in advancing the understanding of this syndrome, providing an indication of clinical treatment, and preventing the relapse of hyperventilation syndrome.

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