Objective: Coronary artery disease (CAD) is a major cause of nontraumatic morbidity and mortality in military personnel. Most studies of the psychosocial impact of CAD have dealt with civilian populations. The purpose of this paper is to highlight differences between military and civilian populations with CAD in 4 areas: depression and anxiety, social support, return to work, and stress.

Method: A computerized literature search from 1985 to 1995 using the search terms “stress,” “cardiovascular,” “cardiac,” “depression,” “military,” “anxiety” and “psychosocial” was undertaken. Controlled and prospective studies of civilian patients were selected along with relevant studies involving military populations.

Results: Unique characteristics of the military may be important factors in affecting the psychosocial outcome of military patients with CAD. These characteristics include a high level of denial of illness, strong social supports, a powerful military work ethic, and stressful situations unique to the military.

Conclusions: Most studies of the psychosocial impact of CAD are based on civilian populations. A review of available studies suggests that little is known about how military patients adapt to CAD, particularly with regard to symptoms of depression and anxiety, social impairment, and rates of return to work. Studies in this area are needed regarding the psychosocial aspects of CAD in military populations.


Key Words: coronary artery disease, psychosocial, military, stress, depression, anxiety

The prevalence of CAD in young military personnel was first noted during World War II. In 1948, Yater and others (1) first reported on 866 American soldiers below the age of 39; more than half of these CAD patients came to autopsy, and the remainder survived myocardial infarction. The frequency of “silent” coronary atherosclerosis among military personnel was noted by Enos and others (2) in 1953 and by McNamara and others (3) in 1971 in autopsy studies of battle casualties during Korean and Vietnamese campaigns, respectively. They found that up to 70% of presumably asymptomatic young soldiers had significant CAD. Results of a recent study examining the extent of coronary artery narrowing in a Canadian civilian population (aged 40 years and under) who died suddenly and unexpectedly found 34.4% of the male subjects had significant narrowing (4). In a Canadian study, FitzGibbon and others (5) reported on 130 military subjects aged 39 years and younger, who came to coronary bypass surgery. Between 1971 and 1994, almost 80% of Canadian military personnel having coronary bypass surgery at the National Defence Medical Centre in Ottawa were 49 years of age or younger. In comparison, in 1990, the median age of patients undergoing coronary artery bypass graft (CABG) surgery in a civilian population was 64 years, with 23% over age 70 (6). Most investigators comparing patients operated on in the 1970s and 1980s have found a significant rise in age (6). The effect of the morbidity and mortality due to CAD on military personnel therefore merits attention.

Up to 70% of patients with CAD experience some psychological problems following a major cardiac event, and 18% to 30% suffer from disabling anxiety and depression (6–13). The major areas of investigation have included the incidence of anxiety and depression (8,11,12) and the rehabilitation of
patients with CAD, particularly the rates of return to work after cardiac events (12–17). The psychosocial impact of CABG surgery has received special attention. Randomized clinical trials demonstrate relief of angina and improved exercise tolerance in 70% to 90% of patients after CABG surgery (12,18). Unfortunately, studies demonstrating beneficial effects on psychosocial functioning and quality of life have been less encouraging, and results are often mixed. Almost all of these investigations have been done with civilian patients, and conclusions from these studies may not be applicable to the military for many reasons. Compared with a civilian population, the military has different social, demographic, economic, educational, and occupational characteristics that may affect both prevalence of CAD and the impact of the disease on the quality of life in this population (Table 1).

This review will focus on investigations of the psychosocial status of patients with CAD and the relevance of these studies to a military population. We will examine investigations of 1) anxiety and depression occurring in patients with CAD and, in particular, patients treated with CABG; 2) the effect of social support and military “culture” on morbidity and mortality in patients with CAD; 3) return to work after CABG surgery; and 4) the relationship between psychological stress and CAD. Unique aspects of the military that suggest potential differences from civilian populations in each of these areas will be discussed.

Method

A computerized literature search limited to the English language using the MEDLINE data base was conducted for the years 1985 to 1995. Search terms included “cardiac,” “cardiovascular diseases,” “stress,” “anxiety,” “depression,” and “psychosocial.” Selected references were supplemented by older references known to the authors and also by citations in the selected articles. A computerized literature search was also done using the MEDLINE data base to review the military medical literature from 1985 to 1995 using the following search terms: “cardiovascular diseases,” “military,” “military medicine,” “military personnel,” “military psychiatry,” and “psychosocial.”

Anxiety and Depression

Anxiety and depression are the most extensively investigated psychosocial variables in patients with CAD. Horgan and associates noted that 50% of their population had high scores on measures of anxiety and depression before CABG surgery, and 33% had similar scores postoperatively (19). Other studies have shown that 12% to 57% of patients have persistent psychosocial impairment, anxiety, and depression up to 2 years after surgery (20,21). A study comparing treatment with percutaneous transluminal coronary angioplasty (PTCA) to a group treated with CABG surgery (22) found differences in psychosocial functioning postoperatively, with post-PTCA patients functioning better at 6-month follow-up relative to the postbypass group. Studies assessing mental health after CABG surgery report varied outcomes in psychosocial functioning postoperatively (14,23,24). Two recent prospective studies of patients undergoing CABG reported significant improvement in psychosocial adjustment in the areas of work performance, interpersonal interactions, and mental health compared with their preoperative functioning (14,25). The conflicting reports as to the prevalence of anxiety and depression in patients before and after CABG surgery may reflect methodological differences. Most of these studies have assessed patient self-reports of dysphoric mood and fatigue, both of which are common in medical illness and may not reflect a true depressive disorder. In a more methodologically stringent study, 18% of 50 patients with CAD met criteria for major depression using a research-based diagnostic interview (8).

Depression has also been implicated as a risk factor for CAD incidence, morbidity, and mortality in several prospective studies (26–30). A major depressive disorder occurring in patients with CAD may be predictive of major cardiac events occurring in a 12-month period following cardiac catheterization, independent of the severity of CAD, left ventricular ejection fraction, and smoking (26). Frasure-Smith and associates have recently reported that depression is also a significant predictor of mortality after myocardial infarction and remains an independent risk factor after controlling for left ventricular dysfunction and previous myocardial infarction (28). Depression has also been associated with increased risk of sudden death (31).

There is a small but significant subset of patients with CAD who experience clinically significant anxiety, depression, and impaired psychosocial functioning. It is possible that there is a similar prevalence of depression and psychosocial dysfunction in military patients with CAD, although data are lacking. We found no studies assessing the incidence of depression, anxiety, and psychosocial impairment in military patients with CAD. A study of the effect of group therapy on 14 medically ill military patients, including some with CAD, found 28% had depression and anxiety and 43% had psychological factors affecting their physical condition (32). These rates are similar to the prevalence of psychiatric problems in the general population with chronic medical conditions (33–35).

Depression and anxiety may be undetected in military patients with CAD for several reasons, including physicians’ lack of awareness of the psychological morbidity associated with CAD, patients’ denial of psychological symptoms, and the stigma of psychiatric illness in the military. Denial of either physical or psychiatric illness in the military population
<table>
<thead>
<tr>
<th>Author, year, reference</th>
<th>Focus of study</th>
<th>Total sample size</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yater and others 1948 (1)</td>
<td>Prevalence of CAD in young military men</td>
<td>866</td>
<td>Clinical and pathological aspects of CAD in soldiers below age 39</td>
</tr>
<tr>
<td>Enos and others 1953 (2)</td>
<td>Prevalence of CAD in asymptomatic soldiers during the Korean War</td>
<td>300</td>
<td>77.3% had some degree of CAD</td>
</tr>
<tr>
<td>McNamara and others 1971 (3)</td>
<td>Prevalence of silent CAD in young military men aged 18 to 37</td>
<td>105</td>
<td>Autopsy findings revealed CAD in 45%</td>
</tr>
<tr>
<td>FitzGibbon and others 1987 (5)</td>
<td>Management of CAD in military men 39 years or younger</td>
<td>138</td>
<td>Short-term and long-term results of CABG discussed</td>
</tr>
<tr>
<td>Compton 1992 (32)</td>
<td>Group therapy with chronically ill military members</td>
<td>14</td>
<td>28% with depression and anxiety; increased well-being and reduced medical visits with treatment</td>
</tr>
<tr>
<td>Burton and others 1972 (36)</td>
<td>Delay in diagnosis of CAD in young military men</td>
<td>265</td>
<td>Diagnosis delayed 3.5 times more often if less than 35 years old; time to diagnosis 30 times longer compared with older group</td>
</tr>
<tr>
<td>Lynch and others 1981 (50)</td>
<td>Mortality from CAD in British army personnel compared with civilians</td>
<td>202</td>
<td>Inverse relationship between mortality from CAD and rank; soldiers under 40 higher risk group than officers</td>
</tr>
<tr>
<td>Cozza and others 1991 (51)</td>
<td>Historical perspective on military psychiatry review</td>
<td></td>
<td>Discussion of unique stressors in military society</td>
</tr>
<tr>
<td>Berenson and others 1993 (54)</td>
<td>Cardiovascular health evaluation and promotion for military personnel and families review</td>
<td></td>
<td>Review of programs to study dietary behaviour, smoking, alcohol use, and other CAD risk factors</td>
</tr>
<tr>
<td>Whitney and others 1986 (55)</td>
<td>Cardiovascular risk modification</td>
<td>48</td>
<td>Program reduced risk factors including blood pressure, weight, and lipids</td>
</tr>
<tr>
<td>Ursano and others 1989 (56)</td>
<td>Review of unique aspects of military society review</td>
<td></td>
<td>Unique stressors include social isolation, frequent moves and separation from family, and combat exposure</td>
</tr>
<tr>
<td>Siegler and others 1993 (57)</td>
<td>Study of military as a risk factor for CAD</td>
<td>5814</td>
<td>Veterans were more likely to smoke and consume more caffeine but had lower levels of hostility at mid-life</td>
</tr>
<tr>
<td>Swenson and others 1996 (60)</td>
<td>Psychosocial functioning in military versus civilians with CAD</td>
<td>95</td>
<td>Military patients reported less psychosocial impairment and greater activity levels</td>
</tr>
<tr>
<td>Quinn 1987 (69)</td>
<td>Incidence of silent ischemia in asymptomatic military</td>
<td>36</td>
<td>Ischemic changes on treadmill tests in 55% of sample</td>
</tr>
<tr>
<td>Solis 1991 (70)</td>
<td>Psychosocial stress in Marine officers</td>
<td>900</td>
<td>Military officers had lower stress levels compared with civilians</td>
</tr>
<tr>
<td>Freidman 1991 (71)</td>
<td>Biological approaches in PTSD review</td>
<td></td>
<td>Application of biological markers to treatment</td>
</tr>
<tr>
<td>Kulka and others 1990 (72)</td>
<td>Trauma and effects on Vietnam veterans review</td>
<td></td>
<td>High lifetime prevalence of PTSD in veterans studied</td>
</tr>
<tr>
<td>Goldberg and others 1990 (73)</td>
<td>Twin study of PTSD in Vietnam veterans</td>
<td>2042</td>
<td>16.8% of twins serving in Vietnam had PTSD versus 5% in civilian twins</td>
</tr>
<tr>
<td>Freidman and others 1994 (74)</td>
<td>PTSD in the military review</td>
<td></td>
<td>Review of PTSD in military populations</td>
</tr>
<tr>
<td>Shalev and others 1990 (75)</td>
<td>Life style effects of PTSD</td>
<td>98</td>
<td>Adverse health practices and low effort tolerance found in PTSD group</td>
</tr>
<tr>
<td>Lee and others 1995 (76)</td>
<td>Psychological sequelae of World War II</td>
<td>107</td>
<td>Combat exposure predicted PTSD</td>
</tr>
<tr>
<td>Solomon and others 1988 (77)</td>
<td>Relationship between locus of control, social support, and PTSD</td>
<td>262</td>
<td>Significant relationship was found between locus of control, lack of social support, and development of PTSD</td>
</tr>
<tr>
<td>Solomon and others 1986 (78)</td>
<td>Link between social support and development of PTSD</td>
<td>382</td>
<td>Lack of social support was linked to development of PTSD</td>
</tr>
<tr>
<td>Solomon and others 1987 (79)</td>
<td>Effects of combat on somatic symptoms</td>
<td>804</td>
<td>PTSD was associated with more health problems and somatic complaints than in non-PTSD populations</td>
</tr>
<tr>
<td>Orr 1990 (80)</td>
<td>Focus on the treatment of PTSD review</td>
<td></td>
<td>Discusses association between nonadrenergic activity and sympathetic dysregulation in PTSD</td>
</tr>
<tr>
<td>Freidman and others 1994 (81)</td>
<td>Physiological correlates of PTSD review</td>
<td></td>
<td>Reviews the relevant work in the area of PTSD research</td>
</tr>
<tr>
<td>Balson and others 1986 (83)</td>
<td>Psychophysiological investigations of stress in military populations review</td>
<td></td>
<td>Need to assess individual risk, social system, and military setting to investigate the effects of stress in military personnel</td>
</tr>
<tr>
<td>Gill and others 1985 (84)</td>
<td>Reduction of type A behaviour in middle-aged military population</td>
<td>118</td>
<td>Behaviour modification program effective in modifying type A behaviour with an associated reduction in cholesterol levels</td>
</tr>
<tr>
<td>Leiter and others 1994 (88)</td>
<td>Comparison of coping and levels of stress in men and women</td>
<td>473</td>
<td>Supportive relationships were more salient to women, and women experienced more stress in new work environments</td>
</tr>
</tbody>
</table>
is supported by the need to perform despite physical or emotional discomfort, especially in training or combat situations. Delay in diagnosis of angina was found to be especially common in younger compared with older military men with CAD (36). In this Canadian military study, the diagnosis of symptomatic CAD was delayed 3.5 times more often in patients less than 35 years of age than in patients over 45, and the average time from presentation with symptoms to diagnosis was 30 times longer in the younger age group compared with the older group. The limitation of this study is the lack of a civilian control group. Data are lacking as to whether this delay in diagnosis is unique to the military, or more a reflection of the young age of the patients. It is possible that military patients may underreport psychological or somatic symptoms for fear of being ostracized by other members, who may perceive the patient as “weak,” causing even lower self-esteem and greater depression. Military patients may also be reluctant to report symptoms for fear of jeopardizing promotion or risking medical discharge from the military. Similarly, military physicians may be hesitant to diagnose medical or psychiatric illness in order to protect their patients from these career implications. Studies of the prevalence of anxiety and depression in military patients with CAD must therefore take into account both the possible tendency of military patients to deny psychological symptoms and “put on a brave front” and the physicians’ lack of awareness of psychological morbidity or reluctance to diagnose psychiatric illness.

Social Support and Military Culture

Some investigators have linked social factors such as lack of control, unpredictability, and stressful changes with increased risk of developing CAD. Few social contacts and a small number of goal-directed activities have been reported to be associated with an increased incidence of initial and recurrent myocardial infarctions, and increased social support appears to prevent them (37-39). Studies investigating the epidemiology of CAD in the 1960s and 1970s have also related sociological variables, including education, occupation, social status, marital status, and religious practice, to the risk of morbidity and mortality from CAD (40).

Perception of health status, prior emotional disturbance, and quality of social support appear to be important determinants of psychosocial adaptation in the psychosocial outcome of patients one year after heart surgery (41). The β-blocker Heart Attack Trial found that social isolation and high life stress increase the risk of death following myocardial infarction (42). Adequate social supports may modify the risk associated with psychological stress, such that individuals at highest risk of cardiac mortality are those with elevated stress and lowest social supports (42). A 10-year prospective study found social isolation and poor self-rated general health status to be characteristic of those who died from CAD (43). Social networks as predictors of outcome of cancer, ischemic heart disease, stroke, and hypertension are powerful predictors of 15-year mortality but weak predictors of new disease (44). This suggests that social networks may be more effective in supporting recovery after illness occurred than in preventing the incidence of new disease.

A recent review found a positive association between developing CAD and occupational factors, life stress, and social isolation, with social support appearing to mitigate the effect of other psychosocial risk factors on cardiovascular disease endpoints (45). Lack of social support may predict more severe CAD in persons with type A behaviour (46-48). Williams and others studied 1368 patients with CAD and found that low levels of social and economic resources identify a high-risk group of patients with CAD (49). An annual income of $40,000 or more and involvement in a significant relationship were significantly associated with greater 5-year survival in the cohort studied.

Epidemiological studies suggesting that a higher educational level, a higher socioeconomic status, and strong social support may be associated with better prognosis with respect to cardiovascular disease morbidity and mortality may be highly relevant to a military population. Membership in the military may be beneficial by promoting a sense of “esprit de corps” in belonging to a large but cohesive group, with a resultant enhancement of regaining functional status in the group. The average educational level of military personnel is likely to be higher than the general population with CAD, as there are minimum educational requirements for entry into the military, and most military personnel receive further training in the course of their career. Socioeconomic and educational levels of subgroups of military personnel, however, may also affect the incidence and mortality rates of CAD.

Lynch and Oelmen demonstrated an inverse relation between mortality from CAD and rank in the British army and suggested that, compared with civilian men, soldiers less than age 40 represent a high-risk group—and officers a low risk group—for development of CAD (50). An inverse relationship was found between mortality from CAD and rank in the army similar to that seen in civilian social classes, but soldiers less than age 40 had significantly higher mortality than the civilian controls independent of civilian social class. The authors suggested that higher rates of cigarette smoking among young soldiers compared with officers may also contribute to the difference in risk between the 2 groups as well as the difference between the military and civilian groups. In FitzGibbon and others’ study of military CAD patients below age 39, there were twice as many patients with rank other than officer than would be expected from the proportions in the Canadian military (5). They suggested that a lower level of education and lower socioeconomic status in the other ranks
may have been a contributing factor to the overrepresentation of other-rank patients. They also found a high incidence of smokers in their study (88% versus 52% of the total population in a 1982 Canadian military survey). Smoking, which has been part of military culture (51), was the most common risk factor in a United States military study assessing CAD patients below age 40 (52). At the same time, health promotion is also an integral part of military culture. Obesity is discouraged, and a minimum level of physical fitness is required for most members. The protective effect of regular physical activity was shown to be associated with lower relative risk of myocardial infarction (53). Programs have been designed to modify other cardiovascular risk factors in military personnel and their families, such as serum lipid levels (54,55).

In spite of strong social networks, there are stressors that are common to military society which could adversely affect the psychosocial status of military patients with CAD (51,52,56). The necessity of posting many military members and their families to new locations every few years limits establishment of a strong network of family ties and local friendships. Foreign postings further add to stress, as military personnel and families must accommodate to different cultures. Military personnel are frequently separated from their families for temporary duties, and particular stress occurs when they are in combat situations. Preliminary findings from a recent study suggest that military service may have complex effects on the usual risk factors for CAD (57). Thus there are aspects of military life that could influence the incidence and clinical course of CAD in military personnel, but whether the military milieu actually enhances or impedes overall psychosocial adaptation to CAD is unknown.

### Return to Work

Return to work has received the most attention in the assessment of quality of life in patients undergoing CABG surgery (12). The majority of studies report a steady decline in employment rates postoperatively, with 30% to 80% of patients working after CABG surgery (12,13,23). The Coronary Artery Surgery Study demonstrated no difference between medically and surgically treated patients in return to work at 1-, 3-, and 5-year follow-up (18). Despite returning to work, patients may continue to experience residual impairment in work performance (14). Treatment with PTCA and CABG are associated with similar rates of return to work. Preoperative work status appears to be the major predictive factor for postoperative employment in patients undergoing CABG surgery (6,12,13,19,23,58). Younger patients are more likely to return to work, as are males and patients with a higher educational level (12,13). More physically demanding jobs and severe angina preoperatively were negatively correlated with return to work (13). Hlatky and associates studied 814 men younger than 60 years with documented CAD and found that 25% of their sample were disabled (59).

The most significant independent predictors of work disability were low level of education, history of previous myocardial infarction, high levels of depression, and high levels of hypochondriasis. The level of depression at the initial assessment was the single most predictive variable related to loss of employment at one-year follow-up (59).

Compared with the civilian populations on which these investigations are based, military patients with CAD are more likely to be younger and have a higher rate of return to work. Military membership may also increase the likelihood of returning to work because of strong social networks and administrative encouragement for the patient to remain a valued part of the military unit. In their study of young military men with CAD, FitzGibbon and associates reported that all of their 130 military patients returned to work after CABG and were employed at one year after operation (5). Results of a small preliminary study by the authors comparing psychosocial adaptations in military and civilian groups with CAD found 83% of the military group working full-time compared with 41% of the civilian group (60). The military group was also more active and reported less impairment in psychosocial functioning. On balance, evidence suggests that rate of return to work may be higher in military patients, although there may be instances where the rate of return to work is diminished if a percentage of patients are classified as unfit for duty on the basis of having CAD. Exposure to high-stress situations such as combat may necessitate reclassification to a military occupation with less exposure to both physical and psychological stress, or even discharge from the military on medical grounds. Thus there may be aspects of military service that either promote return to work or impede it in military patients with CAD.

### Stress and CAD

Perception of the environment as distressing or threatening may increase the risk of developing CAD through activation of the sympathetic nervous system, mediated by neurohormonal mechanisms (31,45,61,62). Byrne (61), however, concluded that the evidence for this link is neither consistent nor clear-cut. Investigations in this area have had important methodological inadequacies, including retrospective design, self-report data, and lack of appropriate controls (61). Lown and others have demonstrated that psychological stress affects vulnerability to ventricular arrhythmias, particularly ventricular fibrillation (62). Based on a review of evidence linking stress and sudden death, Frank and Smith concluded that hostility and anger may trigger malignant arrhythmias (63). Mental stress is also likely an important precipitant of myocardial ischemia and, in particular, silent myocardial ischemia (45,64–68). Angiographic studies suggest that atherosclerosis may disturb the normal vasomotor response of coronary arteries to mental stress, causing paradoxical constriction, particularly at points of coronary stenosis (68).
Silent myocardial ischemia may be relevant to military patients with CAD. A study of 39 healthy military men, aged 40 to 56, demonstrated ischemic ST-segment electrocardiogram changes in 20 men (55%) during routine annual physical testing (69). Most of the ischemic changes occurred in men aged 50 to 56. Autopsy studies found significant CAD in approximately 70% of young men who died in combat in both the Korean and Vietnamese wars (2,3). These findings suggest that acute stress in the combat situation might contribute to the genesis of atherosclerosis, although the relative importance of physical versus psychological stress is unclear.

Within the military, certain occupational categories entail higher levels of physical and psychological stress. A recent study found that 900 Marine Corps officers assigned to noncombat environments had lower stress levels than a civilian control group (70). These lower levels of reported stress may reflect greater job security or satisfaction in the military or more defensiveness in response to psychological inquiries, particularly since the experience of suffering may be viewed as a sign of weakness or malinger.

Posttraumatic stress disorder (PTSD) may affect the development and clinical course of CAD in military patients. “Soldier’s heart,” “irritable heart,” and Da Costa’s syndrome have all been used to describe the effect of combat trauma on physiological function in military personnel involved in World War I and World War II (71). Lifetime prevalence of PTSD in Vietnam veterans is high: 30.9% for men and 26.9% for women (72). These results have been corroborated in another recent study (73). Psychiatric sequelae of combat exposure also include major depression and substance abuse (73,74). Risk factors for CAD, including increased frequency of alcohol use, smoking, and dysregulation of food intake (appetite changes, extremes in weight) have been observed more frequently in combat veterans with PTSD than those without PTSD (75). A recent 50-year prospective study of the effects of World War II combat exposure suggests that it is combat exposure combined with physiological symptoms during combat which predict PTSD in follow-up (76). Recent studies also document a link between lack of social support and the development of PTSD in Israeli military personnel involved in combat (77,78).

An association between combat exposure and health problems has also been found (72,75,79). Shalev and associates have demonstrated lower exercise tolerance and cardiac reserve in Israeli soldiers with PTSD when tested on the treadmill (75). A study of Israeli soldiers with PTSD found higher rates of somatic complaints and adverse health practices, including smoking and alcohol use, compared with a control group (79). Although the physical examinations and laboratory tests were normal in this group, the adverse health practices could indirectly affect CAD development. Other investigators have found an association between noradrenergic activity, sympathetic nervous system dysregulation, and PTSD, which could adversely affect exercise tolerance (80,81). A study on civilian populations exposed to the Gulf War showed an increase in reported myocardial infarctions and sudden deaths early in the campaign (82). It is possible that a military population could experience increased risk of sudden death and myocardial infarction under similar conditions, particularly if predisposed to cardiac illness.

In summary, there is evidence that psychological stress may promote the development of CAD and adversely affect those with the disease. Military populations may be at increased risk because of the unique stresses of military life. Balson and associates suggest that investigations of the effects of stress in military populations should have multiple foci which include 1) individual risk factors such as physiological variables, psychological variables, and demographic factors; 2) social system factors such as military unit experiences and family life issues; and 3) military setting factors such as noncombat life, simulated combat environments, and live combat settings (83). Such factors should also be considered when setting up stress reduction programs for healthy military personnel (84,85) and cardiovascular rehabilitation programs for military patients with CAD.

Women and CAD

Almost all the studies reviewed thus far have included only male patients. There may be differences in women with CAD in the psychosocial predictors of death such as time urgency and emotional arousal (86,87). Sex differences in the prevalence of depression and anxiety disorders, as well as in the degree of social support and the types of stress experienced, may also contribute to different psychosocial outcomes in female military personnel with CAD. A recent study of 473 Canadian military men and women found that women undergoing transition into new work environments were more distressed than men, particularly when support systems were impoverished (88). Supportive collegial relationships were of greater salience to women than to men, and women were more concerned with issues of powerlessness when confronting organizational problems.

Conclusions

The military has unique characteristics that may affect the psychosocial outcomes of individuals with CAD.

First, there is a tendency to deny psychological stress, given the importance of expressing confidence, “esprit de corps,” and intolerance of “retreat.” Such an attitude of denial, on the part of either the military patient or physician, could adversely influence psychological or physical morbidity of military patients with CAD. Second, the strong social supports provided by belonging to military society may be
protective with respect to the medical and psychological outcome in patients who have developed CAD. Other social factors may adversely affect this outcome, however, such as frequent postings and a high rate of tobacco use. Third, there is a greater likelihood that military patients will be able to work after myocardial infarction. This may be due to the higher rate of preinfarct employment, the pressure from military superiors and peers to return to work, the military patient’s feeling of obligation to the group (“esprit de corps”), or the younger average age of the military population. Conversely, return to work may be impeded for positions with minimum physical health or fitness standards, such as combat duty or certain foreign postings, where medical care may be unavailable. Such individuals may require reclassification or release from military service. The younger average age of the military population may further have a positive effect on rates of return to work. Fourth, military populations may be exposed to unusual stresses, particularly combat situations, which could promote the development of CAD and adversely affect the physical and psychosocial outcome of patients with CAD.

Our review of the literature documents the psychosocial impact of CAD in military and nonmilitary populations. Research is needed on the influence of psychosocial impairment on return to military work and the physiological effects of stress on military patients with CAD. Studies comparing the strength of social networks in military and civilian populations with CAD may contribute to further understanding the effect of social supports on the morbidity and mortality of patients with CAD. Future studies should also investigate the psychosocial status of female as well as male military patients with CAD.

Clinical Implications

- CAD is an important cause of morbidity and mortality in military personnel.
- Characteristics of military life may positively or negatively affect adaptation to CAD in military patients.
- Such characteristics include denial of illness, strong social supports, the military work ethic, and uniquely stressful situations.

Limitations

- Most studies of the psychosocial impact of CAD are based on civilian populations.
- Little is known about depression, anxiety, social impairment, and return to work in military patients with CAD.

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Résumé

Objectif : Les coronaropathies sont une cause importante de morbidité et de mortalité atraumatiques chez le personnel militaire. Cependant, la plupart des études sur l’incidence psychosociale des coronaropathies ont porté sur la population civile. Le but du présent article est de faire ressortir les différences qui existent entre les populations militaire et civile souffrant de coronaropathies, au niveau des quatre facteurs suivants : dépression et anxiété, soutien social, retour au travail et stress.


Résultats : Les caractéristiques uniques des militaires pourraient être d’importants facteurs qui influent sur l’état psychosocial des militaires souffrant de coronaropathies. Ces caractéristiques incluent un haut degré de dénégation de la maladie, de solides réseaux de soutien social, une puissante éthique du travail militaire et des situations stressantes uniques aux militaires.

Conclusions : La plupart des études sur l’incidence psychosociale des coronaropathies portent sur des populations civiles. Un examen des études effectuées à ce jour laisse croire qu’on en connaît peu sur la façon dont les militaires s’adaptent aux coronaropathies, en particulier en ce qui a trait aux symptômes de dépression et d’anxiété, au dysfonctionnement social et aux taux de retour au travail, et qu’il est donc important d’entreprendre des études sur les aspects psychosociaux des coronaropathies chez les militaires.