Screening for Alcohol Abuse Using the CAGE Questionnaire

BOOKEF BUSH, M.D.
SHEILA SHAW, M.A.
PAUL CLEARY, Ph.D.
THOMAS L. DELBANCO, M.D.
MARK D. ARONSON, M.D.
Boston, Massachusetts

A prospective study of 518 patients admitted to the orthopedic and medical services of a community-based teaching hospital during a six-month period was performed to test the hypothesis that a short, easily administered questionnaire would improve the detection rate by physicians of alcohol abuse. The CAGE questionnaire—a mnemonic for attempts to cut back on drinking, being annoyed at criticisms about drinking, feeling guilty about drinking, and using alcohol as an eye opener—was utilized as a screening instrument. The mean corpuscular volume of red blood cells, liver transaminase levels, and the gamma-glutamyl transpeptidase level were also evaluated as screening tests. The presence or absence of alcoholism and alcohol abuse for a consecutive sample of CAGE-negative patients and all patients answering “yes” to one or more of the CAGE questions was established through the administration of the Michigan Alcoholism Screening Test, a detailed chart review, and analysis of quantity of alcohol consumed. Diagnostic criteria were those described in the Diagnostic and Statistical Manual III. The prevalence of alcohol abuse was 20 percent. The mean corpuscular volume, gamma-glutamyl transpeptidase value, and liver transaminase levels were very insensitive as screening tests. In contrast, the CAGE questionnaire had a sensitivity of 85 percent and a specificity of 89 percent. Only 63 percent of the alcoholic subjects and alcohol abusers were detected by their physicians, and in only 24 percent of these cases did a physician address the problem with the patient. The CAGE questionnaire is a simple, sensitive, and specific screening test for alcohol abusers.

Alcoholism is a chronic, progressive, potentially fatal disease characterized by the continued use of alcohol, despite resulting emotional, social, legal, or physical problems. Health professionals all too often detect the disease when physical disabilities result. Studies that evaluate biochemical and questionnaire tests for alcohol abuse have frequently only used patient populations with mid- to late-stage alcoholism, patients admitted for detoxification or with alcohol-related diagnoses. A screening test should have diagnostic efficacy in patients with both early- and late-stage disease if it is to impart some therapeutic impact on a potentially lethal disease.

This study reports a prospective evaluation of patients admitted to the orthopedic and medical services of our community-university teaching hospital. We used questionnaires, biochemical screening tests, medical record review, and physician interviews to determine the prevalence of alcohol abuse and dependence, the rate of detection by health professionals, and the utility of biochemical and questionnaire screening tests.
PATIENTS AND METHODS

Patient Selection, Data Collection, and Informed Consent. All 912 patients below the age of 75 admitted to the orthopedic and medical services of Boston’s Beth Israel Hospital during a six-month period were eligible for study. One hundred forty-five patients were excluded because they had an admitting diagnosis of schizophrenia or cerebrovascular accident, were unable to speak English, or because the attending physician refused to permit the patient to participate. Two hundred forty-one patients were not interviewed because of early discharge, because they were too ill during the first days of hospitalization, or because of inability of the interviewer to reach the patient or the patient’s physician. These patients did not differ from those studied in terms of sex, age, reason for admission to the hospital, or length of stay. The remaining 521 patients represent the study group.

An interviewer asked each patient to participate in a study that attempted to “measure the effects of diet, drinking, smoking, and exercise on hospitalization.” If the patient agreed, he or she completed a 25-question interview that contained the CAGE questionnaire [1,2]: Have you ever felt you should cut down on your drinking? Have people annoyed you by criticizing your drinking? Have you ever felt bad or guilty about your drinking? Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover (eye-opener)? The patients who answered one or more of the CAGE questions affirmatively are henceforth called CAGE-positive.

Because we were primarily interested in studying patients with a high probability of alcohol-related problems, diagnostic interviews were performed on all of the CAGE-positive patients. In order to obtain information about the sensitivity and specificity of the CAGE questionnaire, we also performed diagnostic interviews on a consecutive sample (102 of 378) of CAGE-negative patients. We obtained written informed consent from all these patients.

The complete evaluation included an in-depth, structured interview to measure the use of alcohol and cigarettes, functional status, and diet, a chart review of the patient’s medical history, and an assay of the patient’s blood for gamma-glutamyl transpeptidase and the mean corpuscular volume of red blood cells. Included in the in-depth interview was the Michigan Alcoholism Screening Test (M.A.S.T.) [3] and a series of questions developed to measure alcohol consumption in the month before admission to the hospital [4]. Each patient’s medical record was reviewed by one of us (B.B.) for the presence of any of the following alcohol-related diagnoses: alcohol withdrawal syndrome, alcohol withdrawal seizures, alcoholic pancreatitis, alcoholic hepatitis, alcoholic cardiomyopathy, and the Wernicke-Korsakoff syndrome.

Diagnostic Criteria. Patients were classified as either alcoholic, alcohol abuser, or normal using standard criteria described in the Diagnostic and Statistical Manual III. The M.A.S.T. questionnaire, which obtains information about difficulties with social relations, problems in employment, and difficulties in control of alcohol intake, and the National Institute on Alcohol Abuse and Alcoholism Intake question-
naire [4] to measure volume of alcohol consumption were used in order to classify our patients.

Patients were classified as alcohol-dependent if any one of the following was present: (1) a consumption of 0.135 ounces of pure alcohol per kilogram of body weight daily for one month (equivalent to a fifth of whiskey per day for a 70-kg person); (2) a M.A.S.T. score of 6 or more; (3) the presence of an “alcohol-related diagnosis” (see Patient Selection). Patients were classified as alcohol abusers if they had either (1) a M.A.S.T. score of 3 to 5 and a consumption of 2 or more ounces of pure alcohol per day (equivalent to five or more drinks a day), or (2) consumption of 4 or more ounces of pure ethanol per day and a M.A.S.T. score of 2 or more.

All other subjects were classified as normal. Patients that told us that they were alcohol-dependent in the past but had stopped drinking (in recovery) would still be considered alcohol-dependent in this analysis. This classification is supported by these patients’ concerns that they continued to be at risk for some alcohol-related diseases and were susceptible to relapse after use of sedatives and other anesthetics.

Detection by Physicians. The detection of alcohol abuse by physicians was determined by interviewing the physicians and reviewing the medical record. If any one physician—attending physician, medical resident, intern, or medical student—listed alcohol abuse as an issue or as a possible problem for the patient, the case was considered “detected.” For example, if a patient was admitted for peptic ulcer disease, and alcohol abuse was included in the differential diagnosis by a house officer, the patient was considered “detected.” If there was no mention of alcohol abuse in the medical record, the attending physician was asked if alcohol abuse was or might have been an issue for the patient. If the answer was affirmative, the patient was considered “detected.”

Because of these interviews, there is a bias to overestimate the detection of alcohol abusers and alcohol-dependent patients by physicians. However, because our study hypothesis assumed that the detection rates were low, and that this is a difficult outcome to measure, we favored obtaining a conservative estimate.

Chemical Analysis. Hematologic and biochemical analyses were all performed by the clinical chemistry and hematology laboratories in our hospital. All blood samples were obtained within 24 hours of admission to the hospital. We specifically analyzed the mean corpuscular volume of red blood cells, the gamma-glutamyl transpeptidase level, and so-called “liver function tests”: alkaline phosphatase, alanine aminotransferase, and aspartate aminotransferase. Any elevation in one or more of these liver function values was considered a “positive test result.”

Data Analysis. All laboratory, questionnaire, and demographic data were stored and analyzed utilizing software developed by SAS Institute Inc., Raleigh, North Carolina. Continuous variables were compared using the Student t test. Dichotomous variables were evaluated using chi-square analysis.

The sensitivity of the CAGE questionnaire in detecting alcohol abuse was calculated by dividing the number of alcohol abusers detected by the CAGE questions by the
total number of persons who were alcohol abusers. The specificity of the CAGE questionnaire was determined by dividing the number of patients who were not alcohol abusers and were CAGE-negative by the total number of persons who were not alcohol abusers. The predictive value of a positive test result was calculated by taking the number of persons with a positive test result who were alcohol abusers and dividing by the total number of alcohol abusers. Because we sampled 100 percent of the CAGE-positive patients and only a percentage of the CAGE-negative patients, the sample was weighted to correct for the higher proportion of patients with positive CAGE results. Therefore, before the sensitivity and specificity of different tests were calculated, the number of patients with negative CAGE results was increased by a factor of 376/102 (total number of CAGE-negative patients/the number sampled). The effect of the weighting on the analysis will make the sensitivity and specificity reported lower than the results obtained without weighting.

RESULTS

Five hundred twenty-one patients were screened with the CAGE questionnaire. One hundred forty-five answered one or more questions affirmatively, and three hundred seventy-six were CAGE-negative. Three of the CAGE-positive patients refused to participate further in the study. Chart review of two of these patients revealed probable alcohol abuse, but these patients were not included in the analysis. Table I shows the demographic characteristics of CAGE-positive and -negative patients.

One hundred four of the patients were alcohol-dependent or alcohol abusers, a prevalence of 20 percent (104 of 518). Thirty of these patients considered themselves to be alcoholics; and of these, 12 reported abstinence from alcohol. Fifty-seven had alcohol-related diseases in their past history. The detection rate was significantly higher on the medical service (73 percent) than on the orthopedic service (24 percent) (p < 0.001). However, the high rate of detection by physicians on the medical service was due primarily to the presence of alcohol-related diagnoses in the alcohol-dependent, medical patients.

Twenty-eight percent of all the patients screened were CAGE-positive. The sensitivity and specificity for alcohol abuse or alcoholism were 85 and 89 percent, respectively. Thirty-seven of these patients were alcohol abusers, and 67 were alcohol-dependent. The CAGE questions detected 70 percent of those who were alcohol abusers and 94 percent of those who were alcohol-dependent. Table II demonstrates how the sensitivity, specificity, and positive predictive values of the CAGE questionnaire varied with the number of affirmative responses to the CAGE questions.

We also evaluated commonly used “screening tests” for alcohol abuse. Table III shows the sensitivities, specificities, and positive predictive values for the gamma-glutamyl transpeptidase value, mean corpuscular volume,
were all quite similar (33 percent), whereas the predictive value of the CAGE questionnaire was 62 percent. If a positive test result is redefined as affirmative responses to two or more questions, the positive predictive value was 82 percent.

The physician recognition and treatment rates are shown in Figure 1. Seventy-nine percent of the alcoholic patients and 27 percent of the alcohol abusers were detected by physicians caring for the patients. When only patients without alcohol-related diagnoses are considered, the difference in the rate of detection between the orthopedic (0 of 23) and medical (seven of 28) services was not significant (p > 0.5). As stated earlier, our methods of ascertaining physician detection of alcohol abusers would tend to overestimate the detection rate. Perhaps a more important estimate of disease detection is obtained by the number of patients offered treatment of counseling. Indeed, only 24 percent (16 of 67) of the alcoholic patients were offered therapy, and none of the alcohol abusers was offered treatment or counseling.

COMMENTS

In this screening survey of patients admitted to the medical and orthopedic services of our community-teaching hospital, we found that 20 percent of the patients used alcohol in an abusive or dependent fashion. Only 80 percent of the alcoholic patients and 27 percent of the alcohol abusers were identified by their health care providers, and only a quarter of these patients were offered some type of alcoholism treatment. In contrast, the CAGE questionnaire performed impressively. It is both a sensitive and specific screening test and offers the promise, if used routinely, of raising the identification rate of such patients substantially.

Alcohol abuse is a major problem in the United States. In 1975, alcohol-related morbidity cost this country almost 43 billion dollars as a result of trauma, crime, lost productivity, and demands on health care services [6]. In 1982, the economic cost was estimated to be as high as 120 billion dollars. In addition to effects on job performance, alcohol abuse has been linked to half of all automobile accidents, half of all homicides, 25 percent of all suicides, and about 40 percent of problems brought to family court. Using records of annual outlays for such indirect costs, in addition to direct expenses for health care, it appears that the cost of alcoholism is about $10,000 for each problem drinker [7]. About one half of this figure is the cost of health care.

There is growing interest in methods to detect alcohol abuse in all of its phases. Interventions by physicians consisting of assessment, brief counseling, and follow-up in the early stages of excessive drinking can yield results comparable to inpatient and outpatient treatment programs [8]. Physicians, however, identified only 63 percent of the alcohol-dependent and -abusive patients in our inpatient population.

Clark [9] has identified a number of obstacles to the diagnosis and therapy of alcohol abuse. The first is a cognitive block—physicians ignorance of the enormous variety of nonspecific symptoms that the alcohol abuser may manifest. Second, the attitudes and values of the provider may prevent the identification of a problem. Denial on the part of the alcoholic patient is a third obstacle to detection and treatment. Given these impediments to diagnosis, what is needed is a simple, sensitive method to screen for the presence of alcohol abuse.

There are two types of screening tests for alcohol abuse: questionnaires that elicit the psychosocial consequences of unhealthy drinking, and laboratory indicators of alcohol-related hematologic and biochemical disorders. Liver function tests [10], uric acid measurement [11], mean corpuscular volume [12], and gamma-glutamyl transeptidase determination [13] have all been evaluated for their efficacy in detecting alcohol abuse. Even in settings in which the spectrum of alcohol abusers is biased towards patients with late-stage alcoholism (e.g., patients admitted for detoxification), the sensitivities and positive predictive values of these tests are low [14,15]. Eckardt et al [16] separated actively drinking alcoholic patients from normal subjects with a high degree of accuracy by constructing a biochemical profile using the complete blood count and SMA-18 together in a multiple discriminant function, but this study dealt only with actively drinking alcoholic patients admitted to an alcohol treatment program. It did not include patients with preclinical or early-stage alcoholism. In our study, which included
alcohol abusers from early through late stage, the positive predictive values of gamma-glutamyl transpeptidase and mean corpuscular volume were only 33 percent.

Questionnaires that focus on the psychosocial consequences of alcohol abuse have been more effective than laboratory indicators for patients in the early stages of alcohol abuse. Skinner et al. [17] studied young men referred for problems related to alcohol abuse and found that most acknowledged psychosocial problems related to alcohol whereas few had clinical or laboratory manifestations of chronic alcohol abuse. They found also that a questionnaire that elicited a history of trauma identified 70 percent of subjects with drinking problems [18]. Their group recommended that health providers not use a single method to identify alcohol abusers, but instead develop a composite index utilizing the patient’s history, physical findings, and psychosocial and laboratory indicators of alcohol abuse [18,19].

We used the CAGE questionnaire as a screening test because it is a simple, fast test that elicits behavioral symptoms of alcohol abuse and dependence. If a positive CAGE test result is defined as one or more affirmative responses, the sensitivity was 85 percent and the specificity 89 percent. Using two affirmative responses lowered the sensitivity slightly but raised the specificity to 96 percent and the predictive value of a positive test result to 82 percent. Our results are similar to a cohort study of a psychiatric population [14] in which the positive predictive value of the CAGE questionnaire was 50 percent, whereas laboratory indicators had a predictive value of 20 to 40 percent (prevalence of alcohol abuse in the population studied was 11 percent). In our study, the CAGE questionnaire was an effective tool for detecting both alcohol-dependent and alcohol-abusing patients. It identified 70 percent of the alcohol abusers, whereas physicians identified only 27 percent of these patients.

Alcohol abuse is a common problem in both hospitalized and ambulatory patients. It is frequently difficult to identify in the early stages. The CAGE questionnaire is a quick, simple screening test that will identify those patients with both symptomatic and “preclinical” alcohol abuse.

REFERENCES