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Alcohol and Brain Damage

By: James L. Holly, MD

O God, that men should put an enemy in their mouths to steal away their brains! That we should, with joy, pleasance, revel, and applause, transform ourselves into beasts! ~William Shakespeare, *Othello*

A child who reaches age 21 without smoking, abusing alcohol or using drugs is virtually certain never to do so. – Joseph A. Califano, Jr. Chairman and President, The National Center on Addiction and Substance Abuse at Columbia University.

Hundreds of years before science demonstrated that alcoholism destroys the brain, Shakespeare put these words into the mouth of his character. Now, at a time of the year when holiday celebrations and alcohol seem to go hand in hand, it is worth while to remind everyone that beverage alcohol is toxic to the human body, is the source of great tragedy and will destroy the human brain.

Alcohol-related death and disease

Most reported deaths from alcohol-induced diseases involve chronic heavy use. But individual tolerances to moderate and even light use vary greatly, and many alcohol-related diseases occur but fail to be recognized or reported as alcohol- induced. There is strong evidence that 3 to 10 drinks a week increases risk of breast cancer by 30 to 60%. Alcohol is the most broadly toxic substance legally on the market for internal consumption, and is far more toxic than many substances currently banned or restricted by the FDA.

The reported, directly alcohol-induced U.S. annual death rate is at least 100,000, which is 3 times the combined illegal drug death rate, 5 times the homicide rate, and twice the U.S. deaths in the entire 9 yr Vietnam War. Adding the alcohol- induced accident deaths (about 25,000) and alcohol-related suicides (about 13,000), and all unreported or unrecognized alcohol-induced fatal diseases, we

likely approach or exceed the 375,000 annual death rate from smoking. None of this includes all of the non-fatal effects of alcohol on individuals and society in terms of disease, family dysfunction, and costs of non-productivity and health care, etc.

Youth Use of Alcohol

The average age when youth first try alcohol is 11 years for boys and 13 years for girls, which is highly suggestive that they get the alcohol at home. According to research by the National Institute on Alcohol Abuse and Alcoholism, adolescents who begin drinking before age 15 are four times more likely to develop alcohol dependence than those who begin drinking at age 21.

It has been estimated that over three million teenagers are out-and-out alcoholics. Several million more have a serious drinking problem that they cannot manage on their own. The three leading causes of death for 15- to 24- year-olds are automobile crashes, homicides and suicides -- alcohol is a leading factor in all three. Dependence on alcohol and other drugs also associated with psychiatric problems such as depression, anxiety, oppositional defiant disorder or antisocial personality disorder.

Alcoholism and Brain Damage

About half of the nearly 20 million alcoholics in the United States seem to be free of brain impairments. In the remaining half, however, thinking and emotional difficulties can range from mild to severe. For example, up to 2 million alcoholics develop permanent and debilitating conditions that require lifetime custodial care.

Most alcoholics with neuropsychological (brain) impairments show at least some improvement in brain structure and functioning within a year of abstinence, but some people take much longer. Unfortunately, little is known about the rate and extent to which people recover specific structural and functional processes after they stop drinking.

Risk Factors that influence alcohol-related brain damage

Alcoholism's effects on the brain are diverse and are influenced by:

- the amount of alcohol consumed
- the age at which the person began drinking (teenage alcohol use is related to a significantly higher incidence of adult alcoholism and chronic brain damage)
- the duration of drinking
- the patient's age
- level of education
- gender

- genetic background
- family history of alcoholism
- neuropsychiatric risk factors such as alcohol exposure before birth
- general health status

Examples of other medical conditions which are associated with brain damage from alcohol use include:

- Medical conditions such as malnutrition and diseases of the liver and the cardiovascular system
- Neurological conditions such as head injury, inflammation of the brain (i.e., encephalopathy), and fetal alcohol syndrome (or fetal alcohol effects)
- Psychiatric conditions such as depression, anxiety, post–traumatic stress disorder, schizophrenia, and the use of other drugs.

Models for explaining alcohol-related brain damage

Premature Aging Hypothesis

According to this hypothesis, alcoholism accelerates natural chronological aging, beginning with the onset of problem drinking. An alternate version suggests that older patients (age 50 and older) are especially susceptible to the cumulative effects of alcoholism, and aging is accelerated only later in life.

Gender

It has been hypothesized that women's brain functioning is more vulnerable to alcoholism than men's as women and men metabolize alcohol differently (i.e., women achieve higher blood alcohol contents [BACs] than men after consuming the same amount of alcohol).

Family History

Family history of alcoholism has been found to be important because it can influence such things as tolerance for alcohol and the amount of consumption needed to feel alcohol's effects. Also, studies examining brain functioning in people with and without a positive family history of alcoholism have shown that there are clear differences between the groups on measures of brain electrical activity.

Vitamin Deficiency

Research on malnutrition, a common consequence of poor dietary habits in some alcoholics, indicates that thiamine deficiency (vitamin B_1) can contribute to damage deep within the brain, leading to severe cognitive deficits. The exact

location of the affected parts of the brain and underlying neuropathological mechanisms are still being researched.

Alcohol–Related Brain Atrophy

According to one hypothesis, shrinkage (i.e., atrophy) of the cerebral cortex and white matter, as well as possible atrophy of basal forebrain regions, may result from the neurotoxic effects of alcohol. Furthermore, thiamine deficiency may result in damage to portions of the hypothalamus (perhaps because blood vessels break in that region).

According to this hypothesis, alcoholics who are susceptible to alcohol toxicity may develop permanent or transient cognitive deficits associated with brain shrinkage. (Some people may have better immunity than others to alcohol's toxic effects.) Those who are susceptible to thiamine deficiency will develop a mild or transient amnesic disorder, with short–term memory loss as the salient feature.

Patients with dual vulnerability, those with a combination of alcohol neurotoxicity and thiamine deficiency, will have widespread damage to large regions of the brain, including structures deep within the brain such as the limbic system. These people will exhibit severe short–term memory loss and collateral cognitive impairments.

Vulnerability of the Right Hemisphere

Some investigators have hypothesized that functions controlled by the brain's right hemisphere are more vulnerable to alcoholism–related damage than those carried out by the left hemisphere. Each hemisphere of the human brain is important for mediating different functions. The left hemisphere has a dominant role in communication and in understanding the spoken and written word. The right hemisphere is mainly involved in coordinating interactions with the three– dimensional world (e.g., spatial cognition).

Alcoholics may seem emotionally "flat" (i.e., they are less reactive to emotionally charged situations), and may have difficulty with the same kinds of tasks that patients with damage to the right hemisphere have difficulty with. New research has shown that alcoholics are impaired in emotional processing, such as interpreting nonverbal emotional cues and recognizing facial expressions of emotion.

Disruption of Neurotransmitter Systems

Brain cells (i.e., neurons) communicate using specific chemicals called neurotransmitters. Neuronal communication takes place at the synapse, where cells make contact. Specialized synaptic receptors on the surface of neurons are sensitive to specific neurotransmitters. Alcohol can change the activity of

neurotransmitters and cause neurons to respond (excitation) or to interfere with responding (inhibition), and different amounts of alcohol can affect the functioning of different neurotransmitters.

Over periods of days and weeks, receptors adjust to chemical and environmental circumstances, such as the changes that occur with chronic alcohol consumption, and imbalances in the action of neurotransmitters can result in seizures, sedation, depression, agitation, and other mood and behavior disorders.

Conclusion

Tragicly, all of the science in the world cannot release alcohol's captives from the bondage in which they are held. Yet, perhaps, this warning, particularly about the reality that one of the major risk factors for adult alcohol abuse is teenage alcohol use, will encourage parents to make it their responsibility to make sure that alcohol is not available to children or teenagers either at home, at friend's homes, at school functions or in the community.

As a teenager, there was alcohol present in my community, yet I never was exposed to it. I always wondered why. As a young adult, I discovered is was because of my father. No one offered me alcohol because no one wanted to have to deal with my father, and everyone knew that if I had used alcohol, my father would have first dealt with me and then he would have found where I got it and dealt with the source. It would be a fine day again, if rather than asking, "May I see your ID," others asked, "By the way, who is your father?"

Remember, it is your life – and you have only one – and it is your health – and you have it only once.