Alcohol Effects

It is now widely recognized that alcohol is more than a beverage. Alcohol is a drug. When ingested, it has specific and predictable physiological effects on the body-any body, every body. Usually attention is paid to the physical impact of chronic use or what happens with excessive use. Often overlooked are the normal, routine effects on anyone who uses alcohol. Let us examine what happens to alcohol in the body-how it is taken up, broken down, and how it thereby alters body functioning.

DIGESTION

The human body is well engineered to take the foods ingested and change them into substances needed to maintain life and provide energy. Despite occasional upsets from too much spice or too much food, this process goes on without a hitch. The first part of this transformation is called digestion. Digestion is like a carpenter who dismantles an old building, salvages the materials, and uses them in new construction.

- Digestion is the body's way of dismantling food to get raw materials required by the body. Whether alcohol can be called a food was at one time a big point of controversy. Alcohol does have calories. One ounce of pure alcohol contains 210 calories. To translate that into drinks, an ounce of whiskey contains 75 calories and a l2-ounce can of beer contains 150 calories. Alcohol's usefulness as a food is limited, however. Sometimes alcohol is described as providing "empty calories." It does not contain vitamins, minerals, or other essential nutrients. Also, alcohol can interfere with the body's ability to use other sources of energy. As a food, alcohol is unique in that it requires no digestion. Since alcohol is a liquid, no mechanical action by the teeth is required to break it down. No digestive juices need be added to transform it into a form that can be absorbed by the bloodstream and transported to all parts of the body.

ABSORPTION

What happens to alcohol in the body? Surprisingly, absorption of alcohol begins almost immediately with a very small amount taken up into the bloodstream through the tiny blood vessels in the mouth. But the majority goes the route of all food when swallowed-into the stomach. If other food is present in the stomach, the alcohol mixes with it. Here too some alcohol seeps into the bloodstream. Up to 20% can be absorbed directly from the stomach. The remainder passes into the small intestine to be absorbed. The amount of food in the stomach when drinking takes place has important ramifications. Alcohol is an irritant. It increases the flow of hydrochloric acid, a digestive juice secreted by cells of the stomach lining. Anyone who has an ulcer and takes a drink can readily confirm this. This phenomenon explains the feeling of warmth as the drink goes down. The presence of food serves to dilute the alcohol and diminish its irritant properties.

The amount of food in the stomach is a big factor in determining the speed with which the alcohol is absorbed by the bloodstream. The rate of absorption is largely responsible for the feeling of intoxication-thus the basis for the advice "Don't drink on an empty stomach." The presence of food slows absorption. How much and how quickly alcohol is absorbed depends both on the total amount of alcohol in the stomach contents and the relative proportion of alcohol to food. The greater the amount of alcohol and the smaller the amount of food in the stomach, the more rapidly the alcohol is absorbed into the bloodstream and the higher the resulting blood alcohol level. A sex-based difference also seems to influence blood alcohol levels. This is related to differing amounts of an enzyme produced by the stomach lining that promotes the breakdown of alcohol (more on this later). Because women have significantly lower levels of this enzyme, more of the alcohol they drink remains available to enter the small intestine and be taken up by the blood. Therefore if women and men consume equivalent amounts of alcohol, women will have a higher blood alcohol concentration.

In addition to the impact of food in the stomach, the rate of absorption varies with the type of beverage. The higher the concentration of alcohol in a beverage (up to 50%, or 100 proof), the more quickly it is absorbed. This partially explains why distilled spirits have more apparent "kick" than wine or beer. In addition, beer contains some food substances that slow absorption. Carbon dioxide, which hastens the passage of alcohol from the stomach, has the effect of increasing the speed of absorption. Champagne, sparkling wines, or drinks mixed with carbonated soda give a sense of "bubbles in the head."

Now, on from the stomach to the pyloric valve. This valve controls the passage of the stomach's contents into the small intestine. It is sensitive to the presence of alcohol. With large concentrations of alcohol, it tends to get "stuck" in the closed position-a condition called pyloro spasm. When pylorospasm occurs, the alcohol trapped in the stomach may cause sufficient irritation and distress to induce vomiting. This is what accounts for much of the nausea and vomiting that may accompany too much drinking. A "stuck" pylorus also may serve as a self-protective mechanism. It may prevent the passage into the small intestine of what might otherwise be life-threatening doses of alcohol.

BLOOD ALCOHOL CONCENTRATION (BAC)

In considering the effects of alcohol, several questions come to mind. How much alcohol? And, in how large a person? How fast did the alcohol get there? Is the blood alcohol level rising or declining? Let us consider each of these in turn.

The concentration of alcohol in the blood is the first concern. One tablespoon of sugar mixed in a cup of water yields a much sweeter solution than a tablespoon diluted in a gallon of water. Similarly, a drink with I ounce of alcohol will give a higher blood alcohol level in a 100-pound woman than in a 200-pound man. In fact, it will be virtually twice as high. Her body contains less water than his. The second factor is rate of absorption, which depends both on the amount and concentration of alcohol in the stomach and how rapidly it is ingested. So quickly drink a scotch on the rocks on an empty stomach and you will probably be more giddy than if you drink more alcohol more slowly, say in the form of beer after a meal. Even with a given blood alcohol level, there is greater impairment the faster the level has been achieved. Impairment is based on both the amount absorbed and the rate of absorption. Finally, on any drinking occasion, there are different effects for a particular blood alcohol level depending on whether the blood alcohol level is going up or coming down.

Once in the small intestine, the remainder of the alcohol (at least 80%) is very rapidly absorbed into the bloodstream. The bloodstream is the body's transportation system. It delivers nutrients that the cells require for energy and picks up wastes produced by cell metabolism. By this route, too, alcohol is carried to all parts of the body. Although blood alcohol levels are almost universally used as the measure of alcohol in the body, this does not mean that alcohol merely rides around in the bloodstream until the liver is able to break it down. Alcohol is both highly soluble in water and able to pass rapidly through cell walls. Therefore it is distributed uniformly throughout the water content of all body tissues and cells. For a given blood alcohol level, the alcohol content in the tissues and cells varies in proportion to their amount of water. The alcohol content of liver tissue is 64% of that in the blood; of muscle tissue, 84%; of brain tissue, 75%. It takes very little time for the tissues to absorb the alcohol circulating in the blood. Within 2 minutes brain tissues will accurately reflect the blood alcohol level.

BREAKDOWN AND REMOVAL

The removal of alcohol from the body begins as soon as the alcohol is absorbed by the bloodstream. Small amounts leave unmetabolized through sweat, urine, and breath. The proportion of alcohol in exhaled air has a constant and predictable relationship to the blood alcohol concentration-which is the basis for the use of breathalyzers. These routes, at most, only account for the elimination of 5% of the alcohol consumed. The rest has to be changed chemically and metabolized to be removed from the body.

In 1990, a joint Italian-United States research group, headed by Mario Frezza and Charles Lieber, published new findings on metabolism. These were front page news, particularly because they identified differences between men and women. The breakdown, or metabolism, of alcohol occurs in a multistep process. The first step is its change to acetaldehyde. The enzyme that accomplishes this is called alcohol dehydrogenase, referred to as ADH. Before Frezza and Lieber's work this enzyme was thought to be present and active only in the liver. They, however, identified a gastric form of ADH. The breakdown of alcohol that occurs in the stomach is termed "first-pass metabolism." For nonalcoholic men, the amount of alcohol that can be metabolized by the stomach may be as great as 30% of the alcohol consumed. Nonalcoholic women will metabolize only half that amount in the stomach. Therefore, greater proportions of alcohol enter the bloodstream of women. For both sexes, a history of chronic heavy alcohol use leads to a significant decrease in first-pass metabolism.

The acetaldehyde that is formed is itself acted on in the second step of metabolism, by still another enzyme called aldehyde dehydrogenase. Aldehyde dehydrogenase too is present both in the stomach and liver. Then, very rapidly the acetaldehyde produced is metabolized into acetic acid. This is dispersed throughout the body, where it is broken down in cells and tissues to become carbon dioxide and water. The following diagram illustrates the chain of events:

Alcohol → acetaldehyde → acetic acid →. carbon dioxide and water

Dsulfiram (Antabuse@), is a drug used in alcoholism treatment. Disulfiram stops the breakdown of acetaldehyde by blocking acetaldehyde dehydrogenase. Thus acetaldehyde starts to accumulate in the system. It is very toxic, and its effects are those associated with an Antabuse reaction. A better term would be acetaldehyde reaction. The toxicity of acetaldehyde usually isn't a problem. It breaks down faster than it is formed. But disulfiram does not allow this to take place so rapidly-thus the nausea, flushing, and heart palpitations. It has been observed that Asians often have such symptoms when drinking. These are probably based on biochemical differences resulting from genetic differences. In effect, some Asians may have a built-in Antabuse-like response.

Generally the rate at which food is metabolized depends on the energy requirements of the body. Experience will confirm this, especially for anyone who has taken a stab at dieting. Chopping wood burns up more calories than watching the VCR. Eat too much food and a storehouse of fat begins to accumulate around the middle. By balancing our caloric intake with exercise, we can avoid accumulating a fat roll. Again, as a food, alcohol is unique. It is metabolized at a constant rate. The presence of large amounts at a particular moment does not prompt the liver to work faster. Despite alcohol's potential as a fine source of calories, increased exercise (and hence raising the body's need for calories) does not increase the speed of metabolism. This is probably not news to anyone who has tried to sober up someone who's drunk. It is simply a matter of time. Exercise may only mean that you have to contend with a wide-awake drunk rather than a sleeping one. He or she is still intoxicated. The rate at which alcohol is metabolized may vary a little between people. It will also increase somewhat after an extended drinking career. Yet the average rate is around 0.5 ounce of pure alcohol per hour-roughly equivalent to one mixed drink of 86-proof whiskey, or a 4-ounce glass of wine, or one 12-ounce can of beer. The unmetabolized alcohol remains circulating in the bloodstream, "waiting in line." The presence of alcohol in the blood, and hence the brain, is responsible for its intoxicating effects.

ALCOHOL'S ACUTE EFFECTS ON THE BODY

What is the immediate effect of alcohol on the various body organs and functions?

Digestive system

As already noted, alcohol is an irritant. This explains the burning sensation as it goes down. Alcohol in the stomach promotes the flow of gastric juices. A glass of wine before dinner may thereby promote digestion by "priming" the stomach for food. But with intoxicating amounts, alcohol impedes or stops digestion.

Circulatory system

In general, acute use of alcohol has relatively minor effects on the circulatory system in healthy individuals. In moderate amounts, alcohol is a vasodilator of the surface blood vessels. The vessels near the skin surface expand, which accounts for the sensation of warmth and flush to the skin that accompanies drinking. Despite the feeling of warmth, body heat is lost. Thus whoever sends out the St. Bernard with a brandy cask to the aid of the snow-stranded traveler is misguided. Despite the illusion of warmth, a good belt of alcohol will likely further cool off the body.

Kidneys

Anyone who has had a couple of drinks may well spend some time traipsing back and forth to the bathroom. The increased urine output is not caused by alcohol's direct action on the kidneys, nor is it due simply to the amount of liquid consumed. This phenomenon is related to the effect of alcohol on the posterior portion of the pituitary gland located at the base of the brain. The pituitary secretes a hormone that regulates the amount of urine produced. When the pituitary is affected by alcohol, its functioning is depressed. Therefore too little of the hormone is released and the kidneys form a larger-than-normal amount of diluted urine. This effect is most pronounced when alcohol is being absorbed and the blood alcohol level is rising.

Liver

The liver is very sensitive to the acute effects of alcohol. It has been demonstrated that for any drinker, not just heavy drinkers, even relatively small amounts of alcohol (1 to 2 ounces) can lead to accumulation of fat in liver cells.

The liver performs an incredible number of different functions-a very important one is its role in maintaining a proper blood sugar level. Sugar (the body's variety, called glucose) is the only source of energy that brain cells can use. Because the brain is the master control center of the body, an inadequate supply of food has far-reaching consequences. When alcohol is present in the system, the liver devotes all of its "attention," so to speak, to metabolizing it. This may well interfere with the normal liver function of maintaining a steady adequate supply of blood sugar. In the liver there is a stored form of glucose (glycogen) that usually is readily available. However, if one has had an inadequate diet, or has not eaten much for a day or two, glycogen may not be present. At such times the liver normally would use a more complicated biochemical process to transform other nutrients such as protein into glucose. This process is called gluconeogenesis. However, in the presence of alcohol this complicated maneuver is blocked. In such cases hypoglycemia can result. In a hypoglycemic state there is a below-normal concentration of blood sugar. The brain is deprived of its proper nourishment. Symptoms include hunger, weakness, nervousness, sweating, headache, and tremor. If the level is sufficiently depressed, coma can occur. Hypoglycemia may be more likely to occur and may be more severe in individuals who already have liver damage from chronic alcohol use. But it can occur in otherwise normal people with healthy livers who have been drinking heavily and have not been eating properly for as little as 48 to 72 hours.

In individuals with adequate diets, other metabolic effects of alcohol may cause abnormally high levels of blood glucose. This is called hyperglycemia, which is a state similar to that occurring in diabetics.

In view of its potentially significant effect on blood sugar levels, the danger posed by alcohol for the diabetic is obvious. The liver also plays an important role in the metabolism of other drugs. The presence of alcohol can interfere with this role and be responsible for some alcohol-drug interactions. As mentioned before, the liver enzyme ADH is essential to the metabolism of alcohol. Quantitatively, it is the liver's major means of metabolizing alcohol. The liver does have a "backup" system, however. This secondary system is called MEOS (short for microsomal ethanol oxidizing system), and it is located in intracellular structures called microsomes. While termed a backup system for metabolizing alcohol, it is believed that this secondary system only begins to help out significantly in removing alcohol after longterm heavy drinking. It is mentioned here because it is a major system in metabolizing other drugs, including many prescription drugs.

Acutely, the MEOS activity is inhibited dramatically by the presence of alcohol. Therefore other drugs are not broken down at the usual rate. If other drugs in the system have a depressant effect similar to that of alcohol, the central nervous system will be subjected to both simultaneously. However, with some drugs there are additional potential problems. Suppose someone is taking a prescription drug, such as phenytoin (Dilantin) or warfarin sodium (Coumadin), at set intervals and also drinks. The presence of alcohol acutely interferes with the metabolism of the medication; thus when the next scheduled dose is taken, substantial amounts of the earlier dose remain and cumulative toxic effects may occur.

Central nervous system

The major acute effect of alcohol on the central nervous system (CNS) is that of a depressant. The common misconception that alcohol is a stimulant comes from the fact that its depressant action disinhibits many higher cortical functions. It does this in a somewhat paradoxical fashion. Through the depressant effects of alcohol, parts of the brain are released from their normal inhibitory restraints. Thus behavior that would ordinarily be "censured" can occur. Acute alcohol intoxication, in fact, induces a mild delirium. Thinking becomes fuzzy; and orientation, recent memory, and other higher mental functions are altered. An electroencephalogram (EEG) taken when someone is high would show a diffuse slowing of normal brain waves associated with this mild state of delirium. For the light, occasional drinker these acute effects are, of course, completely reversible. Regular heavy use over time presents a different story.

Without question, the CNS, particularly the brain, is the organ system most sensitive to the presence of alcohol. This sensitivity is what being "high," drunk, intoxicated, or impaired is all about. The neurophysiological basis for intoxication is better, but certainly not fully, understood. Without a doubt the intensity of the effect is directly related to the concentration of alcohol in the blood and hence the brain, but even here there are several other influences. The degree of intoxication is also dependent on whether the blood alcohol level is rising, falling, or constant. It is known that the CNS and behavioral effects of a given blood alcohol concentration (BAC) are greater when the blood alcohol level is rising. This is called the Mellanby effect. It is as if there were a small "practice effect," or short-term adaptation by the nervous system to alcohol's presence. Thus for a given blood alcohol level, there is more impairment if the blood level is rising than is found with the same BAC when the level is falling.

The drug alcohol is a CNS depressant. It interferes with the activity of various brain centers and neurochemical systems-sometimes with seemingly paradoxical results. A high BAC can suppress CNS function across the board, even to the point of causing respiratory arrest and death. At lower doses it may lead to the activated, giddy, poorly controlled, and disinhibited behaviors that are typical of intoxication. This is not due to stimulation of CNS centers that mediate such behavior. Rather it is attributable to the indirect effect of selective suppression of inhibitory systems that normally keep such behavior in check.

Watch or recall someone becoming intoxicated and see the progression of effects. The following examples refer to the CNS effects in a hypothetical "average" male. Of course the observed effects of differing numbers of drinks over an hour in any given person may vary considerably. However, the type and severity of behavioral effects that do occur are a direct function of the amount of alcohol consumed; they progress in a fairly predictable fashion.

The "drinks" used in the following examples are a little under one-half ounce of pure alcohol, the equivalent of a 12-ounce beer, a 4-ounce glass of wine, or an ounce of 86-proof whiskey. Many generous hosts and hostesses mix drinks with more than 1 ounce of alcohol, even in the context of a quite proper cocktail party. Then there are college fraternity parties. They often ladle out some spiked punch of unknown alcohol content. Or there are the adolescents who, at an impromptu party out in the woods, simply pass the bottle around. So, as you read on, don't shrug off the "ten-drink" section as an impossibility.

One drink

With 1 drink, the drinker will be a bit more relaxed, possibly loosened up a little. Unless he chugged it rapidly, thus getting a rapid rise in blood alcohol, his behavior will be little changed. If he is of average height and weighs 160 pounds, by the end of an hour his blood alcohol level will be 0.02. An hour later all traces of alcohol will be gone.

Two and one-half drinks

With 2 1/2 drinks in an hour's time, your party-goer will have a 0.05 blood alcohol level. He's high. The "newer" parts of the brain, those controlling judgment, have been affected. That our friend has been drinking is apparent. He may be loud, boisterous, making passes. Disinhibited, he is saying and doing things he might usually censor. These are the effects that mistakenly cause people to think of alcohol as a stimulant. The system isn't really hyped up. Rather, the inhibitions have been suspended, due to the depression by alcohol of the parts of the brain that normally give rise to them. At this time our friend is entering the danger zone for driving. With 2.5 drinks in an hour, 2.5 hours will be required to completelv metabolize the alcohol.

Five drinks

With 5 drinks in an hour, there is no question you have a drunk on your hands, and the law would agree. A blood alcohol level of 0.10 is sufficient to issue a DWI in any state. It is more than enough for states with a lower legal limit for intoxication. By this time the drinker's judgment is nil. ("Off coursh I can drive!") In addition to the parts of the brain controlling judgment, the centers controlling muscle coordination are depressed. There's a stagger to the walk and a slur to the speech. Even though the loss of dexterity and reaction time can be measured, the drinker, now with altered perception and judgment, may claim he has never functioned better. For all traces of alcohol to disappear from the system, 5 hours will be required.

Ten drinks

This quantity of alcohol in the system yields a blood alcohol content of 0.20. More of the brain than just the judgment, perceptual, and motor centers are affected. Emotions are probably very erratic-rapidly ranging from laughter to tears to rage. Even if your guest could remember he had a coat-which he may not because of memory impairment-he'd never be able to put it on. For all the alcohol to be metabolized, 10 hours will be required. He'll still be legally drunk after 6 hours.

Sixteen drinks

2 six-packs + 4 beers With this amount of alcohol, the drinker is stuporous. Though not passed out, nothing the senses take in actually registers. Judgment is gone, coordination wiped out, and sensory perception almost nil. With the liver handling roughly 1 ounce of alcohol per hour, it will be 16 hours, well into tomorrow, before all the alcohol is gone

Twenty drinks

not quite a fifth of whiskey At this point, the person is in a coma and dangerously close to death. The vital brain centers that send out instructions to the heart and breathing apparatus are partially anesthetized. At a blood alcohol level of 0.40 to 0.50, a person is in a coma; at 0.60 to 0.70, death occurs.

ACUTE OVERDOSE AND TOXICITY

With alcohol as with many other drugs, an acute overdose may be fatal. Usually this occurs when very large doses of alcohol are consumed within a very short period of time. Rapid absorption of the ingested alcohol leads to a rapid and steep rise in BAC. In a relatively brief period, this may lead to loss of consciousness, coma, progressive respiratory depression, and death. Thus a "chug-a-lug" contest can be a fatal game.

In general, the acute lethal dose of alcohol is considered to be from 5 to 8 mg/kg of body weight-the equivalent of about a fifth to a fifth and a half of 86-proof liquor for the typical 155-pound male. Acute doses of this amount of alcohol can be expected to result in BACs in the range of 0.35 to 0.70. Alcohol overdoses with fatal outcomes are consistently associated with BACs in this range, which is not at all surprising. It is known that a BAC above 0.40 will severely, and all too likely, lethally depress respiratory function.

Of course, the exact lethal dose and BAC in any individual will vary with age, sex, general physical health, and the degree of prior tolerance to alcohol. All things being equal, a very large, healthy, young adult male will tolerate a dose of alcohol that might well be fatal for a small, medically ill, elderly female. This is true, only more so, for the alcohol-dependent person, who has established tolerance, compared with the alcohol-naive novice drinker. Thus the alcoholic person may tolerate an acute dose of alcohol that would kill an otherwise comparable nonalcoholic individual. Although chronic heavy drinking and a high tolerance to alcohol may provide the alcoholic individual with some margin of safety, this protection is finite. Even the most severely dependent person may do himself in by consuming enough alcohol in one drinking bout to raise the BAC to the upper end of the lethal range. Therefore it is probably fair to say that a BAC of 0.70 or higher is certain to be lethal to anyone. The higher the level within the 0.35 to 0.70 range, the- greater the risk of death.

Differences in women

Substitute a 120-pound woman in the previous examples, and the weight differential would dramatically speed up the process. A woman and a man who have identical body weights and who both drink the same amounts of alcohol will have different blood alcohol levels. Hers will be higher. Women and men differ in their relative amounts of body fat and water. Women have a higher proportion of fat and correspondingly lower amounts of water. This difference is significant, since alcohol is not very fat-soluble. Her body contains less water than his in which to dilute alcohol, which results in her having a higher concentration of alcohol in her blood.

Simply on that basis, let's contrast a 120-pound woman to our hypothetical 160-pound male drinker. With 1 drink in I hour, she would have a BAC of 0.04; 2)1, drinks, and her BAC would be up slightly over 0.10. By 5 drinks, she'd have a 0.21 reading. Should she make it through 11 drinks, she'd be in a coma with a blood alcohol level of 0.45.

Despite biological differences between people, every human body reacts to alcohol in basically the same way. This is true despite the fact that for a given blood alcohol level, a very heavy drinker who has developed tolerance to alcohol may show somewhat less impairment in function than an inexperienced drinker would. This uniform, well-documented response enables the law to set a specific blood alcohol level for defining intoxication. The blood alcohol level can be easily measured by blood samples or a breathalyzer. The breathalyzer is able to measure blood alcohol levels because just as carbon dioxide in the blood diffuses across small capillaries in the lungs to be eliminated as exhaled air, so does alcohol. The amount of carbon dioxide in exhaled air is directly proportionate to that circulating in the bloodstream. The same is true for alcohol. The breathalyzer measures the concentration of alcohol in the exhaled air. From that measurement the exact concentration of alcohol in the blood can be determined.

TOLERANCE

The immediate effects of consumption of the drug alcohol have been described. With continued regular alcohol use over an extended period, changes take place. Tolerance develops, and any drinker, not only the alcohol-dependent individual, can testify to this. The first few times someone tries alcohol, one drink is enough to feel tipsy. With some drinking experience, one drink no longer has that effect. In part this may reflect greater wisdom. The veteran drinker has learned "how to drink" to avoid feeling intoxicated. The experienced drinker has learned to sip, not gulp, a drink and avoids drinking on an empty stomach. The other reason is that with repeated exposures to alcohol, the CNS adapts to its presence. It can tolerate more alcohol and still maintain normal functioning. This is one of the properties that defines alcohol as an addictive drug. Over the long haul the body requires a larger dose to induce the effects previously produced by smaller doses.

Not only does tolerance develop over relatively long spans of time, but there are also rapid adaptive changes in the CNS on each drinking occasion. A drinker is more out of commission when the blood alcohol level is climbing than when it is falling. In a testing situation, if someone is given alcohol to drink and then asked to perform certain tasks, the results are predictable. Impairment is greater on the ascending limb-the rising blood alcohol level, or absorption, phase. As the blood alcohol level drops in the elimination phase, the individual, when similarly tested, will be able to function better with the same blood alcohol content. It is as if one learns to function better with the presence of alcohol after "practice." In fact what probably has happened is that the brain has made some subtle adjustments in the way it functions. Here too there are differences between men and women. Both show greater impairment as alcohol levels rise, but there are differences in the kinds of impairment. When intoxicated, women appear to have greater impairment than men for tasks that require motor coordination. Yet, they are superior to men in tasks that require attention. Since driving requires both skills, neither appears the better bet on the highway.

ALCOHOL AS AN ANESTHETIC

Alcohol is an anesthetic, just as depicted in all the old Western movies. But by modem standards, it is not a very good one. The dose of alcohol required to produce anesthesia is very close to the lethal amount. When the vital centers have been depressed enough by alcohol to produce unconsciousness, it only takes a wee bit more to put someone permanently to sleep. Sadly, several times a year almost any newspaper obituary column documents a death from alcohol. Usually the tragedy involves young people chugging a fifth of liquor on a dare or as a prank, or coerced drinking as part of a college fraternity initiation.

OTHER TYPES OF ALCOHOL

In this discussion of alcohol, it is clear that we have been referring to "booze," "suds," "the sauce," "brew," or any of the other colloquial terms for beverage alcohol. To be scientifically accurate, the kind of alcohol discussed is called ethanol, ethyl alcohol, or grain alcohol. Alcohol, if one is precise, is a term used to refer to a family of substances. What all alcohols have in common is a particular grouping of carbon, hydrogen, and oxygen atoms arranged in a similar fashion in the alcohol molecule. They differ only in the number of carbon atoms and associated hydrogen atoms. Each alcohol is named according to the number of carbons it has. Ethanol has two carbon atoms.

The other kinds of alcohol with which everyone is familiar are wood alcohol (methyl alcohol, with one carbon atom), an ingredient of antifreeze, paint thinners, and sterno. The other is rubbing alcohol (isopropyl), comprised of three carbons. This is a common ingredient in perfumes and after-shave, for example. Because of their different chemical makeup, these other alcohols cause big problems if taken into the body.

The difficulty lies in differences in rates of metabolism and the kinds of by-products formed. For example, it takes 9 times longer for methanol to be eliminated than it does ethanol. Although methanol itself is not especially toxic, when the liver enzyme ADH acts on it, formaldehyde instead of acetaldehyde is formed. Formaldehyde causes tissue damage, especially to the eyes. The formaldehyde then breaks down into formic acid, which is also not as innocent as the acetic acid produced by ethanol metabolism and can cause severe states of acidosis. Ingestion of methylalcohol can lead to blindness and can be fatal; it requires prompt medical attention.

As an interesting aside, the treatment of acute methanol poisoning is one of a handful of situations in clinical medicine where ethanol has a legitimate and important therapeutic role. Administering ethanol to a methanol-poisoned patient slows the rate of methanol metabolism, which results in a reduction of the levels of toxic by-products formed. Why? Because ethanol successfully competes with methanol for the limited amount of liver enzyme ADH required for the metabolism of either variety of alcohol. The rapid administration of ethyl alcohol, while at the same time treating acidosis to correct the body's acid-base imbalance, may ameliorate or entirely eliminate serious complications.

Poisonings from nonbeverage alcohols don't happen only to those alcohol-dependent persons who in desperation will drink anything. Several years ago there was an Italian wine scandal in which table wines were laced with methanol, resulting in more than one hundred deaths. A far more common accident involves the toddler who gets into the medicine cabinet or the teenager or adult who doesn't know that all alcohols are not the same and that some may have dangerous effects.

THE INFLUENCE OF EXPECTATIONS

The focus in this chapter has been on the pharmacological properties of alcohol. The physical changes described, especially alcohol's effects upon the CNS, are directly tied to the amount of alcohol consumed. Pharmacologists refer to this phenomenon as "dose-related" effects. However, our psyche also enters into the equation. Although one's beliefs, wishes, or attitudes cannot negate alcohol's actions, they do have an impact. A person's expectations influence the experience of drinking and how a drinking episode is interpreted. There is increasing literature on this alcohol "expectancy" effect, which examines how beliefs about alcohol's effects influence drinking behavior. Some of these studies involve research situations in which people think they are getting alcohol when, in fact, the drink they consume has none. The explanation for this interaction between pharmacological effects and beliefs is that beliefs are likely to influence what in your surroundings you notice and tune in to while drinking. Thus the person who expects that drinking makes people more aggressive is likely to see others as "asking" for a fight, whereas the person who thinks that drinking enhances sexuality will be attuned to "invitations" for intimacy.

From: Loosening the Grip, 2000, by Jean Kinney