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# Alcohol toxicology for civil lawyers

## DON'T LET A HOSPITAL'S FAULTY BLOOD-ALCOHOL TEST DEVALUE YOUR CASE DUE TO CONTRIBUTORY NEGLIGENCE (YOUR GUY WAS DRUNK!)

The results of chemical tests for alcohol (often referred to as "ethanol" or "ETOH") in the blood of a victim or perpetrator can have a major impact on liability and, in turn, damages.

Civil plaintiffs' attorneys usually try to establish that the decedent was not impaired, and not comparatively at fault or a legal cause of her own harm or demise.

Plaintiffs' attorneys also have the rowing oar to establish the defendant was legally intoxicated while engaging in tortious conduct. While it is true defense attorneys will endeavor to show their clients were sober or unimpaired, the burden of proof in a civil case is always the plaintiff's and therefore, mastery of the forensic testing and some chemistry is just as important in working up a civil case as it is in a criminal prosecution.

Far too often, attorneys have no idea what kind of chemical testing was *actually* employed in the cases they're handling, which inevitably leads to erroneous conclusions and ultimately, cases are usually resolved for less than they merit.

A "toxicologist" is *unfamiliar* to many newcomers in alcohol and drug-related torts or deaths and that gives rise to trepidation because the plaintiff's attorney anticipates skyrocketing expert costs. By contrast, toxicology experts are go-to experts in the civil-defense realm because of the significant information they provide to help evaluate liability and, many times, damages.

Ironically, obtaining the appropriate documentation and having a fairly elementary understanding of the testing involved will allow counsel to save costs by determining whether a toxicologist might assist the client – and what to obtain for that expert to keep the consulting cost reasonable. So too, one learns how to manage the introduction of helpful, or exclusion of hurtful, alcohol-related testimony and evidence.

Retaining a toxicologist after gathering records and testing, at the very outset of the case, even before the lawsuit is filed, allows a greater opportunity to conduct targeted discovery as well as convey expertise.

Familiarity with chemical tests and pertinent records for alcohol-related prosecutions or defenses will eliminate errors that could prejudice the client, the case and everyone connected to it. This article introduces the reader to alcohol-related testing and issues that can cast doubt on the accuracy of chemical tests intended to determine if an individual is impaired because of alcohol.

### "Screening tests" versus "confirmation tests"

Forensically speaking, there are two broad types of tests. The first type is a "screening test" or preliminary test. This is a quick and "dirty" test that has virtually no false-negative results but casts

Journal of Consumer Attorneys Associations for Southern California
ADVOCATE
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a wide net, resulting in a tradeoff: in order to avoid false-negative results, a high number of false-positive results are allowed.

Many attorneys are unaware of this distinction and resolve cases based on screening tests that *almost always* can be excluded by motions in limine.

Therefore, the results of screening tests, unless they are supported by additional clinical and/or circumstantial evidence, should be viewed with skepticism. In support of this notion, a leading forensic pathology textbook (DiMaio, V. J., & Dana, S. E., Handbook of Forensic Pathology (2006)) is often quoted, "No scientist should go to court and testify a drug was definitely present in an individual or specimen based solely on a screening test!" (*Id*. at p. 262.) It is very important to note that, in the thousands of cases the author has reviewed, *all* of the alcohol tests performed *in hospitals* were screening tests.

Attorneys often assume that tests performed in hospitals must be valid, because it is a hospital after all, and lives are at stake. Hospitals deal with imminent needs, however, and typically do not have time to conduct the second kind of alcohol test, a "confirmatory test." Confirmatory tests are much more accurate than screening tests, are almost always conducted by forensic laboratories (as opposed to hospital laboratories), and almost never have false positives, except in cases such as when the sample is mishandled or by human error.

## Confirmatory testing for alcohol in forensic laboratories

Confirmatory tests are much more time consuming than screening tests and are usually conducted by crime laboratories or a coroner/medical examiner at the behest of law enforcement in a non-emergency setting. With confirmatory tests, laboratories measure the alcohol content of *whole blood* in terms of g/100ml.

By contrast, screening tests measure the alcohol content of *serum or plasma*, which is isolated from whole blood by the removal of cells and clotting factors. Little of the overall blood alcohol content is contained within the blood cells. Therefore, the removal of the blood cells leaves almost the same amount of alcohol in a much smaller volume, resulting in a higher alcohol concentration and, thus, a more definitive reading on the test.

Confirmatory testing for alcohol is accomplished either by dual column gas chromatography (GC) or gas chromatography with mass spectrometry (GC/MS). Both methods give highly accurate measures of the alcohol content in a given sample. However, there are issues that can arise during the collection, storage, and testing of the sample that can alter the test results.

One of the most common issues with confirmatory testing is fermentation, which is facilitated by microbes (bacteria and fungi) that are naturally present in the blood and convert glucose and other substrates into alcohol. Fermentation is more likely to affect test results when there is a delay between blood collection and testing, or when the blood is not stored properly in a refrigerator or freezer.

Therefore, laboratory documents supporting the test result should be reviewed by a qualified toxicologist. In other words, even confirmatory test results can be unworthy of being admitted into evidence.

## Hospital testing for alcohol

Hospital testing for alcohol is almost always conducted by serum enzyme assay, which does *not* measure alcohol directly. Instead, the test measures the byproducts of a chemical reaction in which the enzyme alcohol dehydrogenase (ADH) converts alcohol into acetaldehyde. The sample also includes a reagent – nicotinamide adenine dinucleotide (NAD). The conversion of ethanol by ADH to acetaldehyde facilitates the conversion of NAD into nicotinamide adenine dinucleotide with hydrogen (NADH).

Serum enzyme assays measure the level of NADH at the end of the reaction, which is supposed to correlate with alcohol concentration. In other words, to measure the amount of alcohol in a sample, ADH and NAD are added, resulting in an NADH level at the end of the reaction. This NADH concentration is measured via spectrophotometry (which has its own errors and admissibility issues, but more on that later).

As the ADH catalyzes the alcohol in the sample, the NAD is converted to NADH, and the NADH level is measured to indicate the alcohol level. It is important to note that these tests *never* directly measure the amount of alcohol whatsoever. They only measure the amount of NADH.

## Errors in hospital alcohol testing

There are many errors that can occur with hospital testing, many of which go undetected by the individuals performing the test. The inaccuracy of hospital screening tests is an important issue for civil plaintiffs' attorneys because their clients or decedents are almost always the victims of negligence and almost never have their blood tested by a forensic laboratory using a confirmatory method, at the behest of law enforcement. Therefore, the victim's blood test is only conducted by the hospital via a "screening" test at the hospital when they are treated for injuries.

On the other hand, civil defense attorneys typically represent clients that are accused of causing a bad outcome, for example, a car accident. In such cases, law enforcement almost always responds to the scene, or the hospital where the individuals involved are taken, and takes a blood sample from the person believed to be responsible. These samples are then sent to a forensic laboratory for confirmatory testing. Because defendants' blood tests are confirmatory tests rather than screening tests, they are not prone to the same errors to which plaintiffs' tests are prone. It follows that the admission of uncorroborated hospital screening tests may cause significantly more harm to plaintiffs' prosecutions of personal injury or wrongful-death cases, than to the defense.

Journal of Consumer Attorneys Associations for Southern California
ADVOCATE
April 2021

***Spectrophotometric error***

Spectrophotometry measures the amount of light of a specific wavelength that is absorbed as the light is shone through a sample. The amount of absorbance, or change in brightness of the light as it passes through the sample, is proportional to the amount of substance in the sample that is capable of absorbing light at the specific wavelength used. NADH naturally absorbs light with a wavelength of 340nm.

Some vitamins and other naturally occurring compounds such as flavonoids (for our purposes, we can call them "naturally occurring antioxidants") that are present in fruits, vegetables, fruit beverages, tea, coffee, beer, and wine, to name a few, also absorb light at 340nm. Consumption of any of these items can result in falsely high, or false-positive, test results in hospital screening tests.

***Unexplained error***

The serum enzyme assay is prone to unexplained sporadic errors in the form of inaccurately high readings. Such false high readings are not understood or explained but can result in a margin of error as high as 100%. (Gharapetian, A., et al., Clinical Chemistry (2008) Dehydrogenase Interference with Enzymatic Ethanol Assays: Forgotten But Not Gone, § 54(7), 1251-1252.)

***Errors induced by lactate and lactate dehydrogenase***

In trauma cases, the body releases lactate and lactate dehydrogenase from muscles into the blood. Lactate dehydrogenase catalyzes the reversible conversion of lactate into other compounds, such as pyruvate, which produces the same byproduct as the reaction of ADH and alcohol: the conversion of NAD into NADH.

Serum enzyme assays cannot distinguish between NADH produced from alcohol and NADH produced from lactate. Thus, trauma can cause falsely high, or false-positive, results in hospital screening tests for alcohol. (Okorocha, O., *Hospital Serum Blood Tests versus Common DUI-Related Whole Blood Tests* (2013) TM Cooley J. Prac. & Clinical L., 16, 85, *Okorocha*, Hospital Serum Blood Tests, herein.)

***Error associated with the measurement of serum***

As mentioned earlier, confirmatory forensic blood tests measure the amount of alcohol present in whole blood. Serum does not contain white blood cells (leukocytes), red blood cells (erythrocytes), platelets, or clotting factors. The removal of these components, primarily red blood cells, decreases the total volume of the blood while leaving approximately the same amount of alcohol. Red blood cells are the most abundant type of blood cell and account for almost half of the total volume of whole blood. Depending on the volume of red blood cells (often referred to as the "hematocrit"), naturally present in an individual's blood. The margin of error due to the removal of red blood cells and clotting factors is 10-40%. (*Ibid.*)

***Error due to the difference between arterial blood and venous blood***

The site of the blood draw can have a large impact on the test results. If the blood is drawn from an artery as opposed to a vein (standards for impairment are based on venous blood), the results can be falsely elevated by 40% or more. (*Id.*)

***NADH taken as a supplement***

NADH can be obtained as an over-the-counter supplement in most drug stores, including CVS and Walgreens. NADH supplements are sold under the brand names *Enada*, *Source Naturals NADH*, and *Now Foods NADH*, among others, and are believed to influence how the body uses energy, resulting in lower fatigue, improved mental alertness, alleviation of depression or dementia, or improved athletic performance. Many other over-the-counter supplements, particularly those taken for male enhancement, contain NADH as well. The use of dietary NADH supplements can cause a drastic increase in NADH levels in the blood, leading to falsely high reports of blood alcohol levels. (Okorocha, *supra*, *Hospital Serum Blood Tests* at 85.)

## Breath testing for alcohol

Breath testing is generally only performed by law enforcement on motorists suspected of being impaired by alcohol. Many errors and issues can occur with breath testing.

***Mouth alcohol***

One common source of error in breath tests is mouth alcohol, or residual alcohol in the mouth. The lining of the mouth, dental work, and even food stuck between the teeth can retain or absorb alcohol, causing a breath test to register a higher level of alcohol than it should. Some breath-testing devices have a "slope detector," which tries to detect mouth alcohol by looking for an early spike in the breath sample. Experiments have shown, however, that slope detectors work less than 50% of the time.

***The absorption phase***

The absorption phase is the period of time required for alcohol to be absorbed into the blood after being consumed, which can be as long as two to six hours. (See, Nelson, L. S., et al., Goldfrank's Toxicologic Emergencies (2019 11th ed.).) During the absorption phase, alcohol levels in arterial blood are elevated with respect to those in venous blood.

The alcohol measured in a breath test comes from arterial blood, whereas the standards for impairment are based on venous blood. Therefore, breath tests are prone to false-positive results when a small amount of alcohol was recently consumed and has not yet been fully absorbed into the blood stream.

As a result, when simultaneous breath and blood samples are collected and measured, a breath test can register a blood alcohol level that is 260% higher than the level measured by a blood test. For example, a true blood alcohol concentration (BAC) of "0.07" can be falsely measured by a breath test to be as high as 0.14-0.21. Experiments showing such discrepancies between simultaneous breath tests and blood tests of the same subject have been conducted many times over the years, and the findings are consistent and generally undisputed.

Journal of Consumer Attorneys Associations for Southern California
ADVOCATE
April 2021

(See, Okorocha, O., Commentary: Jaffe DH, Siman-Tov M, Gopher A, Peleg K. *Variability In The Blood/Breath Alcohol Ratio And Implications For Evidentiary Purposes*, J. Forensic Sci (2013) § 58(5), p. 1405.)

***Physiological issues***

Many problems with breath tests can arise due to an individual's physiology. Acid reflux can allow alcohol to travel up the esophagus from the stomach and enter the breathalyzer, which is supposed to measure alcohol from the lungs and not the stomach.

Differences in lung function among individuals can also drastically affect breath-test results. Small individuals have less lung volume than larger individuals, which can result in higher breath test readings. In women, the menstrual cycle drives natural changes in body temperature that can result in falsely high breath-test readings. (See, Okorocha, O., & Strandmark, M., Alcohol Breath Testing: Is There Reasonable Doubt, Syracuse J. Sci. & Tech. L. (2012) 27, 124.)

Erroneous breath-test results often support worse outcomes for defendants than would be supported by an error-free test. Therefore, a lack of understanding of the issues related to breath tests on the part of defense attorneys can do substantial harm to a defendant's case.

## Coroner/medical examiner testing for alcohol

***Redistribution***

Although alcohol does not go through the same kind of postmortem redistribution that other drugs do, there are still reasons that postmortem samples can be unreliable for alcohol testing. The most common reason is the postmortem production of alcohol due to fermentation by bacteria and fungi. Another source of error in postmortem alcohol tests, especially in cases of trauma to the chest cavity, is the transfer of unabsorbed alcohol from the stomach or gut into the blood stream. It is recommended that coroners retrieve a sample of stomach contents for alcohol testing in order to eliminate this source of error; however, it is rarely done.

***Alcohol in postmortem vitreous humor***

In many autopsies, a sample of the deceased individual's vitreous humor is taken. The vitreous humor, or vitreous, is the clear liquid found inside the eyeball and is almost 100% water. The vitreous is collected because, in contrast to blood, it is believed to be resistant to postmortem redistribution and ethanol formation. Vitreous cannot be taken from a living individual without causing severe ocular trauma. Therefore, little is known about the true relationship between postmortem levels of drugs and alcohol in the vitreous and antemortem levels of drugs and alcohol in the blood.

## Drug and alcohol levels in the blood do not predict impairment

A cornerstone of pharmacology and toxicology is that the concentration of a drug or alcohol in the blood is *not* a predictor of impairment. There are many reasons why this is true, the most common of which is "tolerance." (See, Brunton, et al., Goodman & Gilman's The Pharmacological Basis of Therapeutics (12th ed. 2011) at p. 7).

Tolerance vitiates the effect of an intoxicating substance. There are as many as eight types of tolerance, any of which can vitiate impairment. (*Ibid.*) There are often multiple forms of tolerance present at any given time. One study found that some individuals with a BAC of 0.50 or higher showed no impairment whatsoever when examined by emergency room physicians. (See, Roberts, J. R., & Dollard, D., *Alcohol Levels Do Not Accurately Predict Physical or Mental Impairment in Ethanol-Tolerant Subjects: Relevance to Emergency Medicine and Dram Shop Laws* (2010) J. Medical Toxicology, 6(4), 438-442.) The legal limit for driving is a BAC of 0.08, meaning that individuals with a BAC over six times the legal limit for driving showed no sign of impairment.

The issue of tolerance can come into play for both civil plaintiffs and civil defendants when either is accused of driving under the influence. There is a very strong argument to be made that the measurement of BAC alone is not the sine qua non of impairment.

## Conclusion

To bolster or refute a chemical test, it is important to have a toxicologist address known toxicological issues pertaining to the test in question and for the attorney to become aware of the potential issues. The earlier in the case this is done, the better, because earlier consultation allows more time for discovery and strategic depositions. All chemical tests are not equal, and there are many flawed results, especially in hospital testing. Erroneous results of alcohol tests are much more likely to damage a plaintiff's case than a defendant's case. Plaintiffs' attorneys may be unaware of these issues and are far less likely than defendant's attorneys to retain a toxicologist early in the case, or even to retain one at all. This can result in a manifest injustice where the plaintiff is incorrectly believed to be impaired and contributorily negligent, even by the plaintiff's own counsel.

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