Alcohol and Drugs

PAPE & ASSOCIATES

Specializing in Toxicology

TOXICOLOGY REPORTER

Civil Cases

Topics and Case Analysis

Brief Summary and Discussion

ALCOHOL-RELATED TOPICS

DRUG-RELATED TOPICS

Brian E. Pape, Ph.D.

Most of Dr. Pape's work involves civil litigation. Prior and prospective clients are encouraged to discuss a potential case-assignment and Dr. Pape's qualifications, services, and prior testimony.

PAPE & ASSOCIATES

Offices serving New England, Northeastern, and Mid-Atlantic States.

Phone: **800-736-0503**

Fax: **800-736-9096**

Alcohol: Case Analysis

Case analysis usually focuses on five or six case-specific issues:

Alcohol Concentration Test Results
Total Alcohol Consumption
BAC at the Time-of-Interest
Expected Effects Based on BAC
Consistent/Inconsistent Statements
Case-related Comparisons

Alcohol test results:

A premortem and postmortem alcohol test result is almost always a reliable measure of the alcohol concentration in the specimen tested. However, it is still important to consider the following:

Review of the testing process and procedure

This review should include the usual SOPs related to subject identification, preparation prior to obtaining a specimen, specimen transfer-and-processing, test instrumentation and method, standardization, and quality assurance.

Calculation of the equivalent or expected BAC

Examples include the conversion of a blood serum alcohol concentration (BSAC) to an expected or equivalent BAC, range estimates for BAC based on one or more urine alcohol concentration test result(s), and comparison of subject-specific alcohol test results for different biological specimens.

Comparison and/or consideration of case-specific evidence should include the time-course and extent of the subject's use and consumption of alcohol and drugs, the subject's appearance-behavior-demeanor, and the subject's history of alcohol and drug use.

Do these comparisons raise questions regarding the reliability of an alcohol test result or the reliability of testimonial evidence? If there are differences, what are the most reliable inferences or conclusions?

The amount of alcohol consumed (the TAC):

The estimation of a person's total alcohol consumption (TAC) should account for the total amount of alcohol distributed in the subject's body tissues and fluids (TBA) at the time of the collection of a premortem specimen or at the time of death plus the total alcohol elimination (TAE) due to the on-going metabolism and excretion of alcohol between the time alcohol was first consumed and the time the alcohol test specimen was drawn or the time of death.

Total Alcohol Consumption (TAC)

TAC = TAE + TBA

when

TBA is based on the subject's age-weight-height-sex and alcohol test result or equivalent BAC.

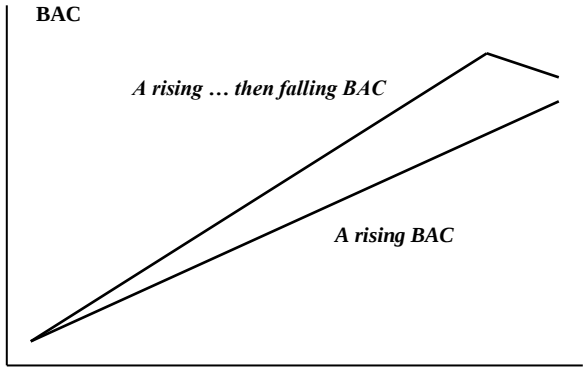
TAE is based on the assumed rate of alcohol elimination or a range for the rate of elimination and the time-period between the first relevant consumption of alcohol and specimen collection or death.

Example: If a 180 pound male had a BAC of 0.15% after drinking for five hours, the subject's TBA would be equivalent to about six drinks and the TAE would be equivalent to about three drinks. Therefore, the TAC would be equivalent to about nine drinks or the amount of alcohol in about 13-1/2 ounces of 80-proof liquor.

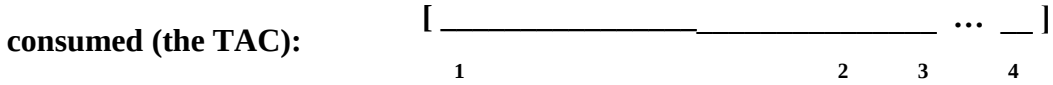
TAE	=	3+ drinks over 6 hours (min.)
TBA	=	6 drinks, given a 0.15%BAC
TAC	=	TBA + TAE
	=	9 drinks (minimum)

Estimation of BAC at a specific time:

The estimation of a subject's BAC at a time-of-interest is usually based on a process of extrapolation that is applied to case-specific information.



A Case-Example Time-Line



When (1) is the time alcohol was first consumed, (2) is the time alcohol was last consumed, (3) is the time-of-interest, (4) is the time the alcohol test specimen was collected, and (1-4) is the time period during which alcohol was eliminated.

There are a variety of ways to estimate BAC at a specific time and, indirectly, form impressions or opinions regarding expected alcohol-related effects and subject-specific or case-specific questions.

An experienced expert can consider different approaches to the estimation of a person's BAC at a specific time. These approaches include the following:

Forward extrapolation
Retrograde extrapolation (*see below)*
Fixed point extrapolation
Range extrapolation
Psychophysical extrapolation

Example: Retrograde extrapolation BAC

If the subject's absorption of alcohol was complete at the time of the accident and the post-accident BAC was falling (i.e. the subject was in a post-absorptive state at the time of the accident), the expected or average or measured rate of elimination and the time between the accident and the collection of the subject's alcohol test specimen and the alcohol test result can be used to estimate the subject's BAC at the time of the accident. An illustration follows.

Retrograde Extrapolation of BAC

Hour	**Event or BAC**
1	Last service of alcohol
2	Last swallow of alcohol
3	MVA (*post-absorptive*)
4	
5	
6	0.120% test result
BAC at MVA	= 0.120% + 3(0.015%)
	= 0.120% + 0.045%
	= 0.165% BAC

Note: This example assumes a post-absorptive rate of elimination of 0.015% BAC per hour.

Alcohol-related effects and risk of accident:

Subject-specific features such as gender and age are related to the risk-of-accident at the same BAC. Other subject-relevant features include tolerance and the use of drugs. Situational-environmental-circumstantial features of interest include familiarity, visibility, weather, and social-occupational-activity-and-context. Studies have established an increased risk of alcohol-related events including those associated with the following:

MVA	**Fall**
Drowning	**Snowmobile**
Fire	**Motorcycle**
Subway and train	**Boating**
Snow skiing	**Horseback riding**
Bicycle	**Hunting**
Electrical	**Assault**
Suicide	**Seizure**
Pedestrian-MVA	**Aquatic accident**
Over-medication	**Workplace injury**

Drugs: Topics

Drug use: Route of entry

Routes of drug use include oral consumption, inhalation, intravenous injection, nasal insufflation, and topical administration.

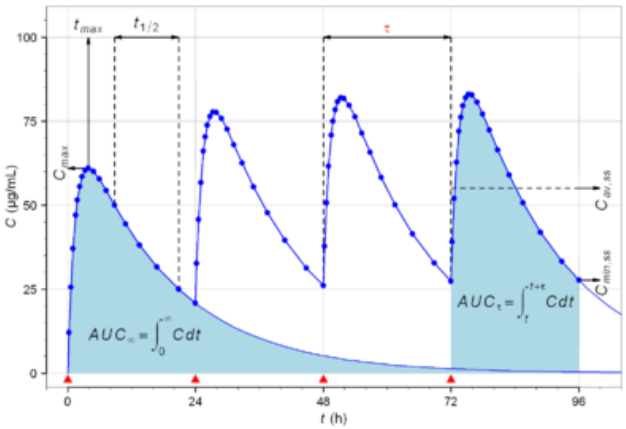
Absorption

The absorption of most drugs is a passive process: The drug moves from a location of higher concentration to a location of lower concentration. Some terms which are related to the time course of drug absorption and blood drug concentration (BDC) include the following.

Cmax usually refers to the highest BDC following a dose of the drug.

Tmax usually refers to the time it takes for the BDC to reach its peak or highest level following administration.

T-1/2 refers to the time required for the drug concentration to decline to one-half of its prior concentration as a result of metabolism and excretion.



Graphical Simulation: The time-course of BDC over 96 hours following oral administrations every 24 hours. Note: It takes multiple doses of a drug before the rise and fall of the drug concentration curves reach what is called a "steady state".

Distribution

Distribution refers to the processes involved in the movement of drugs within and between body tissues and fluids (i.e. physiologic compartments).

Elimination

Elimination refers to the processes that directly result in a reduction of drug concentration:

Metabolism due to enzyme-controlled processes resulting in the formation of drug metabolites that are usually less biologically active than the parent drug and more readily excreted from the body

Chemical decomposition that does not involve an enzyme but which usually results in the formation of products that exhibit less biological activity and an increased rate of excretion

Excretion in biological products or specimens including urine or breath, or extraction by artificial means such as dialysis

Effects

Studies relating to pharmacodynamics and the estimation of the risk of adverse drug-related effects or related consequences have included the following topics:

Acute (shorter-term) v. residual (longer-term) effects

Dose:effect and concentration:effect relationships

For example: What is the relationship between blood drug concentration (BDC) and the risk of occurrence and/or the severity of adverse effects including effects associated with an increased risk of accident or death?

Premortem Drug Testing

Hospital-based patient drug testing:

Qualitative drug testing by immunoassay and the interpretation of a positive test result

Immunoassay Tests: Immunoassays are the most frequently employed hospital-based test methods used to detect the presence of drugs or drug-metabolites in urine. Performance characteristics are used to describe test reliability. Definitions of two of these performance characteristics follow:

False positives: Specimens that should test negative actually test positive.

False negatives: Specimens that should test positive actually test negative.

While hospital laboratories seldom confirm positive drug test results, a positive result is generally consider to be a reliable indication of the prior use of the specific drug or a member of the drug class. However, recent studies suggest that some tests for amphetamines are less reliable than most drug tests.

Interpretation of a positive urine drug test: A true positive urine drug test result means that the person consumed sufficient drug to account for the detection of a specific drug or drug-metabolite or a member of a class of drugs in the urine specimen. However, without case-specific assumptions or reliable evidence, a positive test often does not establish details related to prior drug use:

- When and how the drug was last used?
- How much drug was used?
- Effects at the case-specific time-of-interest?
- Relevance to case-specific issues?

Postmortem Drug Testing

Results review and interpretation:

Qualitative test results

A qualitative drug test result relates to the apparent presence (i.e. detection and prior use) or absence (i.e. no detection) of a specific drug or drug metabolite or class of drugs. It is important to know the drug universe for the test procedure(s) and the sensitivity or detection limit(s) for each drug or class of drugs or drug metabolite(s). *Refer to hospital-based patient drug testing for other relevant considerations.*

Quantitative test results

A case-specific assessment of quantitative accuracy is usually based on the review of laboratory documentation. When considering an evaluation of the accuracy of a quantitative test, you should ask an experienced toxicologist to discuss case-relevance, reported results, processes relating to results review, potential discovery requests, and options including retesting.

When the drug quantitated was prescribed for the deceased, examples of interrelated questions and considerations include the following:

- What was the prescribed dosage regimen?
- Why was the drug prescribed?
- What other drugs were prescribed? Why?
- What do the pharmacy records indicate?
- When was the drug supposed to be taken?
- How was the drug supposed to be taken?
- What were the previously reported effects?
- What do medical or other records indicate regarding prior drug use and effects?
- Are the toxicology test results consistent with the information discussed above?

The approach to case analysis should include a step-by-step process of cross-referencing information and the comparison of evidence and expectation and explanation. When the drug quantitated was not prescribed for the deceased, examples of other interrelated questions and considerations include the following:

- What is known about the source of the drug?
- What is known about how - when - where - in what amount - by what route - with what reported effect the drug was used?
- Were other drugs involved? *See above*
- What is known about the deceased's history during the 24 hours prior to the time of death?