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The Crux

BIMONTHLY FORUM FOR THE LABORATARIANS

CONTENTS

Editorial

There are various diseases that inflict mankind. Some, where, you have no control (autoimmune diseases), others, where you can prevent or delay (like infectious and lifestyle disorders) and still others that people inflict themselves with. In this category fall – the worlds scourges – like addictions of "DRUGS OF ABUSE - DOA". History tells a lot about them. . Nowhere is this more obvious than in the place that opium has played in British history. Imported as an important trade commodity from Turkey and India, opium was widely used in all strata of British society in the eighteenth and nineteenth centuries. The poor sought solace from the miseries of their daily lives, working mothers used opium-containing 'cordials' to calm their children while they went out to work, middle-class housewives took *laudanum* (an alcoholic extract of opium) to calm their nerves, and artists sought inspiration from it. Creation of Hong Kong was indirectly a bye-product of misuse of a DOA by a colonial power. In mid-nineteenth-century in France, cannabis was introduced from Egypt, following the Napoleonic campaign, and became fashionable among many in the literary world who frequented the 'Club des Hashischins' in Paris. In much the same way, when cocaine was first discovered a century ago as the active component in coca leaves, many experts extolled its virtues, and it rapidly gained a short-lived medical acceptance for a multitude of uses. Ironically, one of its popular uses was in the treatment of opium addiction! A more recent example of changing attitudes is the way we view tobacco smoking. The list is endless. Consumption of these substances is like knowingly committing slow suicide. Many therapeutic drugs with psychotic side effects are now also being consumed for deriving "kicks". Morphine is a potent pain killer but also a drug of abuse. The diagnosis of consumption of DOAs can be made either from blood or from urine (by detecting their metabolites). DISEASE DIAGNOSIS portion clearly outlines all clinico-diagnostic aspects of DOAs consumption.

TROUBLESHOOTING segment completes the "phlebotomy" left over from the previous issue.

As Hepatitis B markers could not be completed in the previous issue, the overflow of the same is being carried forward in this issue under "INTERPRETATION".

BOUQUET is slowly turning from all words to few pictures too. Perhaps someday it will turn to all pictures!

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DISEASE DIAGNOSIS

DRUG ABUSE

DEFINITION: Drug abuse has a huge range of definitions related to taking a psychoactive drug or performance enhancing drug for a non-therapeutic or non-medical effect. All of these definitions imply a negative judgement of the drug use in question (compare with the term responsible drug use for alternative views). Some of the drugs most often associated with this term include alcohol, amphetamines, barbiturates, benzodiazepines, cocaine, methaqualone, and opium alkaloids. Use of these drugs may lead to criminal penalty in addition to possible physical, social, and psychological harm, both strongly depending on local jurisdiction.[2] Other definitions of drug abuse fall into four main categories: public health definitions, mass communication and vernacular usage, medical definitions, and political and criminal justice definitions. An estimated 5.6% of the global population aged 15 to 64, or 185 million people, consume illicit drugs annually.

Dependence has two components: physiological and psychological

Physiological Dependence means the individual's body has adapted to a substance such that one's body actually needs the substance for the individual to feel "normal." Psychological Dependence will cause the individual to experience withdrawal symptoms when they stop using the substance.

Why people take drugs: According to the US National Institute on Drug Abuse, people begin abusing substances for a variety of reasons. **To feel good.** Most abused substances produce intense feelings of pleasure. This initial sensation of euphoria is followed by other effects, which differ with the type of substance used. For example, with stimulants such as cocaine, the "high" is followed by feelings of power, self-confidence, and increased energy. In contrast, the euphoria caused by opiates such as heroin is followed by feelings of relaxation and satisfaction. **To feel better.** Some people who suffer from social anxiety, stress-related disorders, and depression begin abusing drugs or other substances in an attempt to lessen feelings of distress. Stress can play a major role in beginning substance use, continuing substance abuse, or relapse in patients recovering from addiction. **To do better.** The increasing pressure that some individuals feel to chemically enhance or improve their athletic or cognitive performance can similarly play a role in initial experimentation and continued substance abuse. **Curiosity** and "because others are doing it." In this respect, adolescents are particularly vulnerable because of the strong influence of peer pressure. They are more likely, for example, to engage in "thrilling" and "daring" behaviors, to include underage drinking and "experimentation" with illegal or legal drugs.

Substance Abuse Definition: A. Any maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by one (or more) of the following, occurring within a 12-month period: Recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or home (e.g., repeated absences or poor work performance related to substance use; substance-related absences, suspensions or expulsions from school; neglect of children or household). Recurrent substance use in situations in which it is physically hazardous (e.g., driving an automobile or operating a machine when impaired by substance use). Recurrent substance-related legal problems (e.g., arrests for substance-related disorderly conduct. Continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance (e.g., arguments with spouse about consequences of intoxication, physical fights). B. The symptoms have never met the criteria for Substance Dependence for this class of substance.

COMMONLY ABUSED DRUGS

Substances: Category and Name	Examples of Commercial and Street Names	DEA Schedule* How Administered**	Intoxication Effects/ Potential Health Consequences
CANNABINOIDS			
hashish	boom, chronic, gangster, hash, hash oil, hemp	I/swallowed, smoked	euphoria, slowed thinking and reaction time, confusion, impaired balance and coordination/cough, frequent respiratory infections; impaired memory and learning; increased heart rate, anxiety; panic attacks; tolerance, addiction
marijuana	blunt, dope, ganja, grass, herb, joints, Mary Jane, pot, reefer, sinsemilla, skunk, weed	I/swallowed, smoked	
DEPRESSANTS			
barbiturates	Amytal, Nembutal, Seconal, Phenobarbital: barbs, reds, red birds, phennies, tooies, yellows, yellow jackets	II, III, V/injected, swallowed	reduced anxiety; feeling of well-being; lowered inhibitions; slowed pulse and breathing; lowered blood pressure; poor concentration/fatigue; confusion; impaired coordination, memory, judgment; addiction; respiratory depression and arrest; death
benzodiazepines (other than flunitrazepam)	Ativan, Halcion, Librium, Valium, Xanax: candy, downers, sleeping pills, tranks	IV/swallowed, injected	Also, for barbiturates—sedation, drowsiness/depression, unusual excitement, fever, irritability, poor judgment, slurred speech, dizziness, life-threatening withdrawal
flunitrazepam***	Rohypnol: forget-me pill, Mexican Valium, R2, Roche, roofies, roofinol, rope, rophies	IV/swallowed, snorted	for benzodiazepines—sedation, drowsiness/dizziness
GHB***	gamma-hydroxybutyrate: G, Georgia home boy, grievous bodily harm, liquid ecstasy	I/swallowed	for flunitrazepam—visual and gastrointestinal disturbances, urinary retention, memory loss for the time under the drug's effects
methaqualone	Quaalude, Sopor, Parest: ludes, mandrex, quad, quay	I/injected, swallowed	for GHB—drowsiness, nausea/vomiting, headache, loss of consciousness, loss of reflexes, seizures, coma, death
			for methaqualone—euphoria/depression, poor reflexes, slurred speech, coma
DISSOCIATIVE ANESTHETICS			
ketamine	Ketalar SV: cat Valiums, K, Special K, vitamin K	III/injected, snorted, smoked	increased heart rate and blood pressure, impaired motor function/memory loss; numbness; nausea/vomiting
PCP and analogs	phencyclidine; angel dust, boat, hog, love boat, peace pill	I, II/injected, swallowed, smoked	Also, for ketamine—at high doses, delirium, depression, respiratory depression and arrest
			for PCP and analogs—possible decrease in blood pressure and heart rate, panic, aggression, violence/loss of appetite, depression
HALLUCINOGENS			
LSD	lysergic acid diethylamide: acid, blotter, boomers, cubes, microdot, yellow sunshines	I/swallowed, absorbed through mouth tissues	altered states of perception and feeling; nausea; persisting perception disorder (flashbacks)
mescaline	buttons, cactus, mesc, peyote	I/swallowed, smoked	Also, Also for LSD and mescaline—increased body temperature, heart rate, blood pressure; loss of appetite, sleeplessness, numbness, weakness, tremors
psilocybin	magic mushroom, purple passion, shrooms	I/swallowed	for for LSD—persistent mental disorders
			for for psilocybin—nervousness, paranoia
OPIOIDS AND MORPHINE DERIVATIVES			
codeine	Empirin with Codeine, Fiorinal with Codeine, Robitussin A-C, Tylenol with Codeine: Captain Cody, schoolboy; (with glutethimide) doors & fours, loads, pancakes and syrup	II, III, IV, V/injected, swallowed	pain relief, euphoria, drowsiness/nausea, constipation, confusion, sedation, respiratory depression and arrest, tolerance, addiction, unconsciousness, coma, death
fentanyl and fentanyl analogs	Actiq, Duragesic, Sublimaze: Apache, China girl, China white, dance fever, friend, goodfella, jackpot, murder 8, TNT, Tango and Cash	I, II/injected, smoked, snorted	Also, for codeine—less analgesia, sedation, and respiratory depression than morphine
heroin	diacetyl-morphine: brown sugar, dope, H, horse, junk, skag, skunk, smack, white horse	I/injected, smoked, snorted	for heroin—staggering gait
morphine	Roxanol, Duramorph: M, Miss Emma, monkey, white stuff	II, III/injected, swallowed, smoked	increased heart rate, blood pressure, metabolism; feelings of exhilaration, energy, increased mental alertness/rapid or irregular heart beat; reduced appetite, weight loss, heart failure, nervousness, insomnia
opium	laudanum, paregoric: big O, black stuff, block, gum, hop	II, III, V/swallowed, smoked	Also, for amphetamine—rapid breathing/tremor, loss of coordination; irritability, anxiousness, restlessness, delirium, panic, paranoia, impulsive behavior, aggressiveness, tolerance, addiction, psychosis
oxycodone HCL	Oxycontin: Oxy, O.C., killer	II/swallowed, snorted, injected	for cocaine—increased temperature/chest pain, respiratory failure, nausea, abdominal pain, strokes, seizures, headaches, malnutrition, panic attacks
hydrocodone bitartrate, acetaminophen	Vicodin: vike, Watson-387	II/swallowed	

Substances: Category and Name	Examples of Commercial and Street Names	DEA Schedule* How Administered**	Intoxication Effects/ Potential Health Consequences
STIMULANTS			
amphetamine	Biphetamine, Dexedrine: bennies, black beauties, crosses, hearts, LA turnaround, speed, truck drivers, uppers	II/injected, swallowed, smoked, snorted	
cocaine	Cocaine hydrochloride: blow, bump, C, candy, Charlie, coke, crack, flake, rock, snow, toot	II/injected, smoked, snorted	
MDMA			
(methylenedioxy-methamphetamine)	Adam, clarity, ecstasy, Eve, lover's speed, peace, STP, X, XTC	I/swallowed	for MDMA—mild hallucinogenic effects, increased tactile sensitivity, empathic feelings/impaired memory and learning, hyperthermia, cardiac toxicity, renal failure, liver toxicity
methamphetamine	Desoxyn: chalk, crank, crystal, fire, glass, go fast, ice, meth, speed	II/injected, swallowed, smoked, snorted	for methamphetamine—aggression, violence, psychotic behavior/memory loss, cardiac and neurological damage; impaired memory and learning, tolerance, addiction
methylphenidate (safe and effective for treatment of ADHD)	Ritalin: JIF, MPH, R-ball, Skippy, the smart drug, vitamin R	II/injected, swallowed, snorted	
nicotine	cigarettes, cigars, smokeless tobacco, snuff, spit tobacco, bidis, chew	not scheduled/smoked, snorted, taken in snuff and spit tobacco	for nicotine—additional effects attributable to tobacco exposure; adverse pregnancy outcomes; chronic lung disease, cardiovascular disease, stroke, cancer, tolerance, addiction
OTHER COMPOUNDS			
anabolic steroids	Anadrol, Oxandrin, Durabolin, Depo-Testosterone, Equipoise: roids, juice	III/injected, swallowed, applied to skin	no intoxication effects/hypertension, blood clotting and cholesterol changes, liver cysts and cancer, kidney cancer, hostility and aggression, acne; in adolescents, premature stoppage of growth; in males, prostate cancer, reduced sperm production, shrunken testicles, breast enlargement; in females, menstrual irregularities, development of beard and other masculine characteristics
Dextromethorphan (DXM)	Found in some cough and cold medications; Robotripping, Robo, Triple C	not scheduled/swallowed	Dissociative effects, distorted visual perceptions to complete dissociative effects/for effects at higher doses see 'dissociative anesthetics'
inhalants	Solvents (paint thinners, gasoline, glues), gases (butane, propane, aerosol propellants, nitrous oxide), nitrites (isoamyl, isobutyl, cyclohexyl): laughing gas, poppers, snappers, whippets	not scheduled/inhaled through nose or mouth	stimulation, loss of inhibition; headache; nausea or vomiting; slurred speech, loss of motor coordination; wheezing/unconsciousness, cramps, weight loss, muscle weakness, depression, memory impairment, damage to cardiovascular and nervous systems, sudden death

Mechanisms of addiction

Drug abuse is an increasing problem in our affluent societies and carries great social and economic costs through its impacts on crime and health. Official policy in the Western world for the past 50 years has been to treat addicts as criminals and to punish them, but this has manifestly failed to prevent the increase in drug abuse. Nor have campaigns to educate people about the dangers of drugs, tobacco, and alcohol had anything other than relatively minor effects. From the neuroscientist's point of view addiction is increasingly seen as an organic disorder of brain function; if this could be better understood we might be able to offer more effective treatments to addicts. The definition of addiction has changed in recent years. The term was previously applied only to such 'hard' drugs as heroin, where there are obvious signs of tolerance and physical dependence in regular users, and a painful or even life-threatening physical withdrawal syndrome when drug use is stopped. Psychiatrists now use the term 'substance dependence' to include both psychological dependence (where there may be no obvious withdrawal syndrome or tolerance) and physical dependence. The cigarette smoker who cannot stop smoking or the cannabis smoker whose drug habit has come to dominate their life is no less addicted than the chronic heroin user, even though they may suffer only mild withdrawal signs when drug use is stopped. Great progress has been made in understanding the mechanisms by which the various classes of addictive substances act in the brain. These include the 'psychostimulants' — a large group of drugs encompassing cocaine and various amphetamines. These drugs all act in the brain to stimulate receptors that recognize the chemical messenger substance dopamine. Cocaine works by blocking the inactivation of dopamine after its release from nerve terminals in the brain — a process that involves recapture of the released chemical into the nerve endings. Blocking this process makes more dopamine available to stimulate brain receptors. The amphetamines work by displacing dopamine from nerve terminals. The 'rave dance' drug, ecstasy, is an amphetamine derivative that combines psychostimulant (dopamine) properties with a mild hallucinogenic effect — thought to be due to stimulation of receptors for another brain chemical messenger, serotonin. The opiates (for example heroin), cannabis, and nicotine all act on specific receptors that are present in the brain and which recognize these different drugs. When the drug binds to the receptor it triggers activity in nerve cells. One might wonder why the brain should contain such receptors, since the drugs themselves are plant products that do not exist naturally in the brain. The answer is that in each case there are naturally-occurring brain chemicals which activate these receptors, and the drug molecules hijack these normal brain mechanisms. Precisely how alcohol works remains unclear, but it is increasingly thought to act by modifying the responsiveness of the brain to the principal 'on' and 'off' chemical signals, glutamic acid and GABA — thus lowering neuronal excitability. Knowing how these drugs act, however, does not explain why they are addictive. Furthermore, there seem to be a bewildering number of different brain mechanisms activated by the different classes of drugs. Consequently, great excitement has been generated in recent years by the first glimmers of some common themes of understanding in this area. One important series of research findings points to a common brain mechanism that is triggered by all known drugs of addiction — namely, the activation of dopamine mechanisms in a region of the forebrain known as the nucleus accumbens. This is a small dopamine-rich brain region underlying the larger dopamine-rich movement control centres, the caudate nucleus and putamen. The nucleus accumbens is part of the limbic forebrain, a brain region known to be important in emotional behaviour and in pain and pleasure. By direct measurements of dopamine release from animal brains, using tiny probes inserted into the nucleus accumbens, it has been found that cocaine, amphetamines, alcohol, nicotine, and cannabis all share the ability to cause increased levels of dopamine. When low doses of the drugs are used, the nucleus accumbens is the only brain region that shows such increased levels of dopamine. Furthermore, rats in which the dopamine-containing nerve terminals in the nucleus accumbens are selectively destroyed (by means of the selective chemical neurotoxin, 6-hydroxydopamine) no longer self-administer amphetamines or cocaine. Could it be that dopamine release in the nucleus accumbens is the common mechanism underlying the pleasurable actions of these drugs? According to this view the drugs simply subvert a normal brain mechanism in which pleasurable or 'reinforcing' stimuli assist the animal in learning to repeat a behaviour. Addiction can be viewed as an 'aberrant form of learning' — the drugs recruit brain mechanisms that have a normal place in cognitive and emotional behaviour and cause these to malfunction, so the addict 'learns' to continue using the drug.

Detection periods: The following chart gives approximate detection periods for each substance by test type. The ranges depend on amount and frequency of use, metabolic rate, body mass, age, overall health, and urine pH. For ease of use, the detection times of metabolites have been incorporated into each parent drug. For example, heroin and cocaine can only be detected for a few hours after use, but their metabolites can be detected for several days in urine. In this type of situation, we will report the (longer) detection times of the metabolites. NOTE 1: Oral fluid or saliva testing results for the most part mimic that of blood. The only exceptions are THC and benzodiazepines. Oral fluid will likely detect THC from ingestion up to a maximum period of 18-24 hours. Low saliva: plasma ratio continues to cause difficulty in oral fluid detection of benzodiazepines. NOTE 2: Urine cannot detect current drug use. It takes approximately 6–8 hours or more post-consumption for drug to be metabolized and excreted in urine. Similarly, hair requires two weeks, and sweat, seven days.

Approximate values for detection periods

Substance	Urine	Hair	Blood
Alcohol	3-5 days via ethyl gluconoride (EtG) metabolite or 6-24 hours via traditional method	up to 90 days	12 hours
Amphetamines (except meth)	1 to 3 days	up to 90 days	12 hours
Methamphetamine	3 to 5 days	up to 90 days	1-3 days

Substance	Urine	Hair	Blood
MDMA (Ecstasy)	4 days	up to 90 days	25 hours
Barbiturates (except phenobarbital)	2 to 3 days	up to 90 days	1 to 2 days
Phenobarbital	2 to 3 weeks	up to 90 days	4 to 7 days
Benzodiazepines	Therapeutic use: 3 days. Chronic use (over one year): 4 to 6 weeks	up to 90 days	6 to 48 hours
Cannabis	Single use: 1-6 days Weekly use: 3-9 days Daily use: 7-30 days	up to 90 days	2 -3 days after infrequent use, up to 2 weeks after frequent use
Cocaine	2 to 4 days with exceptions for certain kidney disorders	up to 90 days	24 hours
Codeine	1 day	up to 90 days	12 hours
Cotinine (a break-down product of nicotine)	2 to 4 days	up to 90 days	2 to 4 days
Morphine	2 days	up to 90 days	6 hours
Heroin	3 to 4 days	up to 90 days	6 hours
LSD	24 to 72 hours (however tests for LSD are very uncommon)	up to 3 days	0 to 3 hours
Methadone	3 days	up to 90 days	24 hours
PCP	3 to 7 days for single use in chronic users	up to 30 days up to 90 days	1 to 3 days

Drug testing methodologies: The different types of drug tests are tested in very similar ways. Before testing the sample, the tamper-evident seal is checked for integrity. If it appears to have been tampered with or was damaged in transit, the laboratory rejects the sample and does not test it. One of the first steps for all drug tests is to make the sample testable. Urine and oral fluid can be used "as is" for some tests, but other tests require the drugs to be extracted from urine beforehand. Strands of hair, patches, and blood must be prepared before testing. Hair is washed in order to eliminate second-hand sources of drugs on the surface of the hair, then the keratin is broken down using enzymes. Blood plasma may need to be separated by centrifuge from blood cells prior to testing. Sweat patches are opened up and the sweat collection component is soaked in a solvent to dissolve any drugs present. Laboratory-based drug testing is done in a two-tiered fashion using two different types of detection methods. The first is known as the screening test, and this is applied to all samples that go through the laboratory. The second, known as the confirmation test, is only applied to samples that test positive during the screening test. Screening tests are usually done by immunoassay (EMIT, ELISA, and RIA are the most common). A "dipstick" drug testing method which could at some future time provide screening test capabilities to field investigators has been developed.. Screening tests are typically less sensitive and more prone to false positives and false negatives than the confirmation test. After a suspected positive sample is detected during screening, the sample is flagged and tested using the confirmation test. Samples that are negative on the screening test are discarded and reported as negative. The confirmation test in most laboratories is performed using mass spectrometry, and is extremely precise but also fairly expensive to run. False positive samples from the screening test will be negative on the confirmation test. Samples testing positive during both screening and confirmation tests are reported as positive to the entity that ordered the test. Most laboratories save positive samples for some period of months or years in the event of a disputed result or lawsuit. For workplace drug testing, a positive result is generally not confirmed without a review by a Medical Review Officer that will normally interview the subject of the drug test.

Types of testing: Pre-employment drug testing: This is by far the most common type of drug test used by businesses, however, it is also the least effective. It is considered to be an "intelligence test" by drug testing professionals. It has the advantage of being inexpensive, since only one test per employee needs to be paid for by the company. However, since most pre-employment drug testing is urine-based and subject to sample adulteration or substitution, the effectiveness of this approach has been questioned by federal legislators. Some organizations have a witness in the room at the time of the testing, but the privacy implications of this, as well as the potential for shy bladder syndrome has limited the use of witnesses outside jails and drug treatment programs. Companies and testing centers that do not use witnesses normally disconnect sources of water from the testing room to discourage dilution, and if there is water in the toilet, it is dyed blue. Other counter measures, such as making the donor change into a gown, may also be used. **Random drug testing:** Random drug testing is the most effective format. In the advanced nations, random drug testing is used by a growing number of corporations, drug rehab centers, prisons, the military, police and fire departments, government agencies, and more recently, schools. It may also be used on teens by their parents, or mandated to be performed at school. The objective of a random drug test is deterrence, as the threat of detection is much higher versus other testing methods. Various random selection methods are used, ranging from drawing names out of a hat to using random number generators. The random selection methodology is often legally questionable because it is difficult to prove that an individual was not targeted. For example, an employer paying a Third Party Administrator to make random selections could easily instruct the administrator to select an individual. Government-mandated testing requires a scientifically provable method of randomization, although there are no government regulations about tamper-proof selection records. Any procedure without tamper-proof records is open to legal challenge because an employer can not prove that the subject was not targeted. The goal of random testing is to discourage drug use among employees, inmates, or students by not telling anyone who or when or where they are to be tested in advance. However, critics claim that random drug testing introduces a presumption of guilt, and is a violation of privacy if the drug user is not actually intoxicated during working hours. In addition, random testing is more likely to catch cannabis users, since THC metabolites are fat soluble and have a longer duration in the body than those of many other drugs. It has been suggested that this could indirectly encourage the use of much more dangerous and harmful drugs that are excreted from the body faster. **Post-incident drug testing:** Post-incident drug testing is not a very commonly administered test compared to the other two, but the financial ramifications of not testing employees after an accident (or other incident) on the job makes this test worthwhile for most businesses. The point of this test is not necessarily to cause the employee to lose his or her job, but rather to protect the company from liability in the event that the individual is under the influence at the time of the accident. If drugs or alcohol are detected in any significant quantity, the argument can be made in court that the individual was intoxicated on the job, and for that reason, the company should not be held liable for injuries sustained by the employee. This argument, however, can only reasonably be made if blood or oral fluid / saliva testing is used. Urine, hair, or sweat based testing can only detect past drug use. Depending upon the facts of each case, this may help a company avoid litigation completely or may do nothing to help their case. DUI testing would also fall into this category. Another time this type of test may be used is if an employee shows up for work intoxicated, has alcohol on his or her breath, or appears to be impaired in some other way. The goal of these tests is to protect the entity from litigation, so they are only given on an as needed basis. It should be noted that in most areas, blood testing is the only legally defensible means for detecting drug use after an incident, although saliva testing is gaining acceptance. The sample should follow chain of custody requirements and should always be sent to a lab after collection. Positive on-site tests that may affect an employee's position or situation should always be followed up with a laboratory test before any action is taken against the employee. Laboratory tests (urine or blood) are the only legally recognized tests in most states as well as in most non-U.S. countries.

Drug testing methods: Urine drug testing: Urine drug test kits are available as on-site tests, or laboratory analysis. Urinalysis is the most common test type and used by federally mandated drug testing programs, yet likely the least effective. The main disadvantages of urine-based drug test kits is/are (1.) the ease at which they can be "cheated" via simple adulteration or substitution, unless specimen collection is directly observed, (2.) inability to detect current / on-the-job drug abuse, (3.) the need for bathroom facilities, and (4.) the inability to test for drugs used in current society. **Urine adulteration testing:** Many labs perform adulteration testing, in which the urine is identified if "cheated". These tests, however, can not keep pace with the various methods available to defeat urine tests. Furthermore, simply drinking 2 liters of water is generally sufficient to defeat a urine-based test, without triggering dilution issues. These adulteration tests examine the properties of urine and identify if there are abnormal levels of oxidants, creatinine and nitrites present. The following chart from Branan Medical Corporation shows the different levels of substances that are normal and abnormal levels in urine.

Normal and Abnormal Urine

	Abnormal	Normal	Abnormal
Creatinine (mg/dl)	0 - 10	20 - 100	
Nitrite (mg/dl)		0 - 10	>50
pH	2 - 3	4 - 10	>11

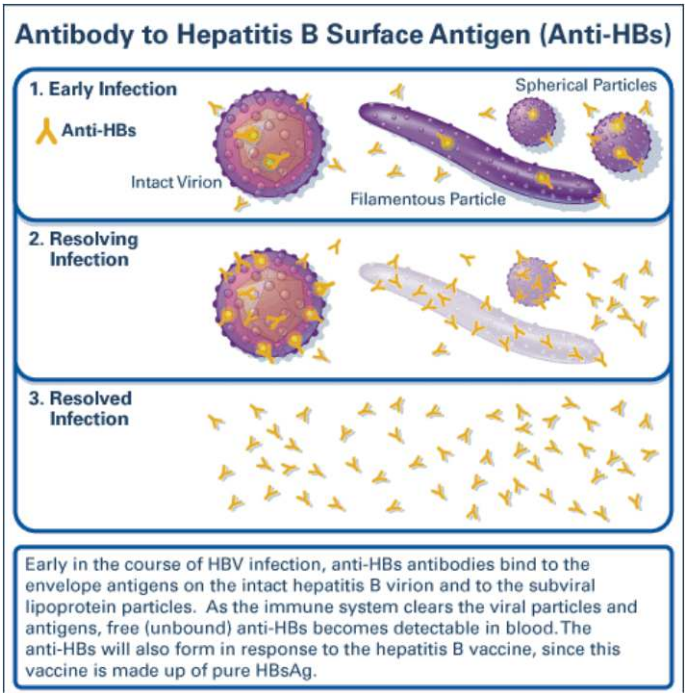
Saliva drug testing: Saliva (oral) drug test kits are very donor friendly, non-invasive and easy to collect the specimen. There is no need for a bathroom to administer the tests. Saliva drug testing tends to detect very recent drug use. Also these drug tests are harder to adulterate than the urine drug tests since the sample can be obtained under direct supervision. Results can be read in minutes, however tend to still take longer and cost more than urine screening tests. Depending on the test, up to 8 (5 or 6 at a time) different drugs could be detected. This method is the best method for determining recent use and is a potential indicator of impairment. While oral fluid in not considered a bio-hazard unless there is visible blood, it should be treated with care. **Spray (sweat) drug testing:** Spray (sweat) drug test kits are non-invasive. It is very easy to collect the specimen and no bathroom is needed for taking the specimen. The detection window is long and usually can detect drug use up to a couple of weeks. These drug tests are relatively tamper proof since they are hard to manipulate. There is no need for a lab and you can get results in minutes. The main disadvantage of spray or sweat based drug testing is the fact that they are open to contamination. Also large variations of sweat production rates of possible donors make some results inconclusive. There is not much variety in these drug tests since they are not as popular as urine or saliva drug testing kits. Their prices tend to be higher per test conducted. One main disadvantage of this testing method is the limited number of drugs that can be detected. **Hair drug testing:** Hair drug testing can provide a much longer window of detection, which is useful for highly safety-critical positions where there is zero tolerance of drug usage. Even if the person being tested has a shaved head (perhaps in preparation for the test), hair can also be taken from almost any other area of the body. This includes facial hair, the underarms, arms, and legs. It costs more than urine testing, and one must have a lab for results. Hair testing is becoming more reliable as technology advances, and there is no known way to adulterate a hair specimen in order to falsify the results of the test, despite what some retailers advertise.

INTERPRETATION

HEPATITIS B MARKERS

(Continued from last issue)

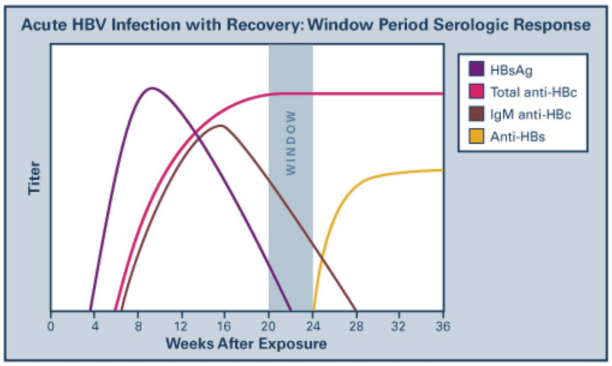
9 Antibody to Hepatitis B Surface Antigen (Anti-HBs)



Test Result	Interpretation
HBsAg (—) Total anti-HBc (—) anti-HBs (—)	Susceptible
HBsAg (—) Total anti-HBc (+) anti-HBs (+)	Immune due to natural infection
HBsAg (—) Total anti-HBc (—) anti-HBs (+)	Immune due to hepatitis B vaccination
HBsAg (+) Total anti-HBc (+) IgM anti-HBc (+) anti-HBs (—)	Acutely infected
HBsAg (+) Total anti-HBc (+) IgM anti-HBc (—) anti-HBs (—)	Chronically infected
HBsAg (—) Total anti-HBc (+) anti-HBs (—)	Four interpretations possible 1. Recovering from acute HBV infection 2. Distantly immune and test not sensitive enough to detect very low level of serum anti-HBs 3. Susceptible with a false positive anti-HBc 4. Chronic HBV infection with rare circumstance where HBV does not produce detectable HBsAg

Serologic Response to Acute HBV Infection

The incubation period (time from the acquisition of HBV to the onset of clinical symptoms) typically consists of 8-12 weeks. The diagnosis of acute HBV infection is established by a characteristic serologic profile. During acute infection, the appearance of virologic markers and host antibody responses develop in a typical pattern. The first serologic marker to appear is hepatitis B surface antigen (HBsAg), which can initially be detected in serum from 1 to 12 weeks (average, 30 to 60 days) after infection. Shortly thereafter, hepatitis B e antigen (HBeAg) generally becomes evident. Although serum HBV DNA assays will show the presence of HBV DNA prior to the appearance of HBsAg or HBeAg, with HBV levels often exceeding 109 virions/ml, this test is not generally performed for the purpose of diagnosing acute HBV infection. About the time that clinical symptoms develop, antibody to hepatitis B core antigen (anti-HBc) appears, primarily detectable as the IgM class (IgM anti-HBc). In addition, with the onset of clinical symptoms, patients will have increases in serum hepatic aminotransferase levels that reflect hepatic injury. The degree of hepatic injury generally correlates directly with the vigor of the immune response. Although IgM anti-HBc antibodies typically decline to undetectable levels within 6 months, the IgG class (IgG anti-HBc) persists indefinitely as a marker of past HBV infection.



Serologic Response With Resolved HBV Infection

Following acute HBV infection, the evolution of the pattern of serologic markers depends on the outcome of the host immune response. The likelihood of the patient resolving HBV infection correlates with their age and the strength of the initial immune response to HBV. Following acute HBV infection, approximately 90% of adults will resolve the HBV infection, whereas 30 to 90% of young children will fail to resolve the infection and thus develop chronic HBV infection. The weak immune response generated by young children acutely infected with HBV generally corresponds with minimal killing of HBV-infected hepatocytes; for this reason, clinical symptoms suggestive of acute HBV infection are frequently absent in this patient population. For those patients who resolve their infection, HBsAg disappears at about 3 to 6 months, often just prior to the detection of antibodies to hepatitis B surface antigen (anti-HBs). The presence of anti-HBs following acute infection generally indicates recovery and protective immunity against re-infection. In addition, patients with resolution of infection have disappearance of HBeAg and development of antibodies to hepatitis B e antigen (anti-HBe). Patients with resolved infection have persistence of anti-HBc for life, but about 4-6 months after the appearance of anti-HBc, the total anti-HBc predominantly consists of IgG. Some patients with self-limited infection, however, may still have low levels of HBV DNA in blood; whether the HBV DNA is part of intact virions remains unknown.

Serologic Result With Chronic HBV Infection

Patients who develop chronic (persistent) HBV infection have a serologic response in the acute phase of HBV infection that is similar to patients who subsequently resolve the HBV infection. With chronic (persistent) HBV infection, HBsAg and anti-HBc (IgG antibodies) generally persist for life and HBV DNA can usually be detected by nucleic acid amplification methods. The presence of HBsAg for longer than 6 months after acute infection indicates chronic infection. The detection of HBsAg and absence of IgM anti-HBc in a single serum specimen also generally indicates chronic HBV infection. Although most persons with chronic HBV infection are without symptoms, they are at risk for subsequently developing chronic hepatitis, cirrhosis, and liver cancer. The

continued presence of HBeAg generally reflects higher HBV DNA levels and greater infectiousness. Some patients with chronic HBV infection may have resolution of their HBeAg along with appearance of anti-HBe, and this usually correlates with low (or absent) HBV levels and relatively normal levels of hepatic aminotransferase levels. Previously, investigators believed that HBV DNA disappeared in all patients with the onset of anti-HBe, but older studies had used the less sensitive HBV DNA hybridization assays. Newer, more sensitive PCR assays have shown that greater than 70% of persons who develop anti-HBe have persistent HBV DNA, typically in the range of 1000 to 100,000 molecules/ml. In addition, some patients with chronic HBV infection have absent HBeAg, increased aminotransferase levels, and relatively high HBV DNA levels; these findings generally occur in association with precore or core promoter mutations. These mutations prevent (or diminish) HBeAg formation by an otherwise normally replicating HBV.

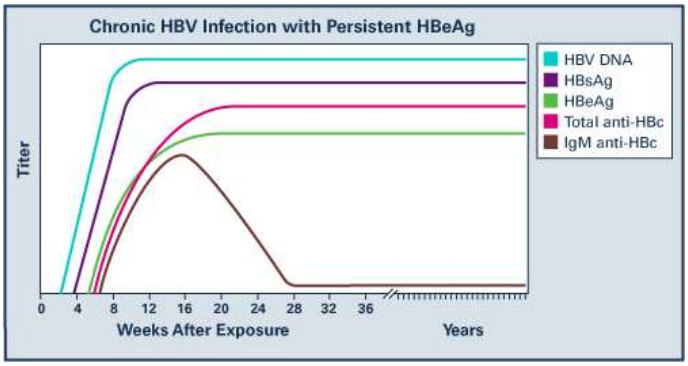


Figure 4. Virologic and Serologic Markers in Patients who Progress to Chronic Hepatitis B Virus Infection with Persistent HBeAg

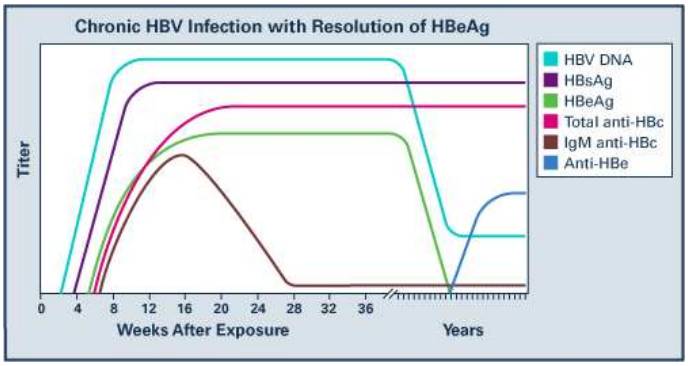


Figure 5. Virologic and Serologic Markers in Patients who Progress to Chronic Hepatitis B Virus Infection with Resolution of HBeAg

BOUQUET

In Lighter Vein

*John was a salesman's delight when it came to any kind of unusual gimmicks. His wife Marsha had long ago given up trying to get him to change. One day John came home with another one of his unusual purchases. It was a robot that John claimed was actually a lie detector machine.

It was about 5:30 that afternoon when Tommy, their 11 year old son, returned home from school. Tommy was over 2 hours late. "Where have you been? Why are you over 2 hours late getting home said John.

"Several of us went to the library to work on an extra credit project," said Tommy.

The robot walked around the table and slapped Tommy, knocking him completely out of his chair.

“Son," said John, "this robot is a lie detector, now tell us where you really were after school.”

"We went to Bobby's house and watched a movie." Said Tommy.

"What did you watch?" asked Marsha.

"The Ten Commandments. " answered Tommy.

The robot went around to Tommy and once again slapped him, knocking him off his chair.

With his lip quivering, Tommy got up, sat down and said, "I am sorry I lied. We really watched a tape called 'Sex Queen.'"

“I am ashamed of you son," said John. "When I was your age, I never lied to my parents.”

The robot walked around to John and delivered a whack that nearly knocked him out of his chair.

Marsha doubled over in laughter, almost in tears and said, "Boy, did you ever ask for that one! You can't be too mad with Tommy. After all, he is your son!"

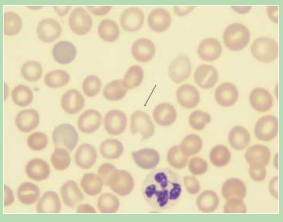
The robot walked around to Marsha and knocked her out of her chair.

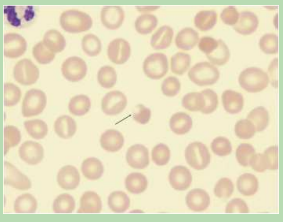
Wisdom Whispers

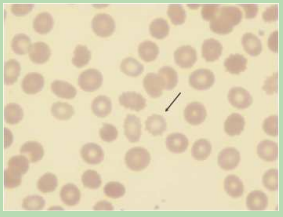
- "On poor people's beards the young barber learns his trade." - German Proverb
- "Life is the continuous adjustment of internal relations to external relations."
- The mouse is knowing, but the cat more knowing." - Danish Proverb
- "They who deserve honour, fail of it; and they who obtain it, do not deserve it." - German Proverb
- "The devil's boots don't creak." - Scottish Proverb
- Chastise a good child, that it may not grow bad, and a bad one, that it may not grow worse." - Danish Proverb
- "Before you mount, look to the girth." - Dutch Proverb
- "Take a horse by his bridle and a man by his word." - Dutch Proverb
- "Where there are bees, there is honey." - English Proverb
- "Do as ye would be done to." - Scottish Proverb

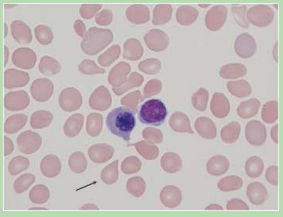
Brain Teasers

Identify the cells marked by arrows in the pictures given below.

1. 

2. 

3. 

4. 

Answers: 1. Bite cell 2. Blister cell 3. Echinocyte 4. Dacryocyte

TROUBLESHOOTING

PHLEBOTOMY

BLOOD COLLECTION: (Continued from last issue)

Patient Preparation Factors: Therapeutic Drug Monitoring: different pharmacologic agents have patterns of administration, body distribution, metabolism, and elimination that affect the drug concentration as measured in the blood. Many drugs will have "peak" and "trough" levels that vary according to dosage levels and intervals. Check for timing instructions for drawing the appropriate samples. Effects of Exercise: Muscular activity has both transient and longer lasting effects. The creatine kinase (CK), aspartate aminotransferase (AST), lactate dehydrogenase (LDH), and platelet count may increase. Stress: May cause transient elevation in white blood cells (WBC's) and elevated adrenal hormone values (cortisol and catecholamines). Anxiety that results in hyperventilation may cause acid-base imbalances, and increased lactate. Diurnal Rhythms: Diurnal rhythms are body fluid and analyte fluctuations during the day. For example, serum cortisol levels are highest in early morning but are decreased in the afternoon. Serum iron levels tend to drop during the day. You must check the timing of these variations for the desired collection point. Posture: Postural changes (supine to sitting etc.) are known to vary lab results of some analytes. Certain larger molecules are not filterable into the tissue, therefore they are more concentrated in the blood. Enzymes, proteins, lipids, iron, and calcium are significantly increased with changes in position. Other Factors: Age, gender, and pregnancy have an influence on laboratory testing. Normal reference ranges are often noted according to age.

SAFETY AND INFECTION CONTROL: Because of contacts with sick patients and their specimens, it is important to follow safety and infection control procedures.

PROTECT YOURSELF: Practice universal precautions: Wear gloves and a lab coat or gown when handling blood/body fluids. Change gloves after each patient or when contaminated. Wash hands frequently. Dispose of items in appropriate containers. Dispose of needles immediately upon removal from the patient's vein. Do not bend, break, recap, or resheath needles to avoid accidental needle puncture or splashing of contents. Clean up any blood spills with a disinfectant such as freshly made 10% bleach. If you stick yourself with a contaminated needle: Remove your gloves and dispose of them properly. Squeeze puncture site to promote bleeding. Wash the area well with soap and water. Record the patient's name and ID number. Follow institution's guidelines regarding treatment and follow-up. NOTE: The use of prophylactic zidovudine following blood exposure to HIV has shown effectiveness (about 79%) in preventing seroconversion.

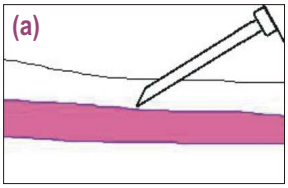
PROTECT THE PATIENT: Place blood collection equipment away from patients, especially children and psychiatric patients. Practice hygiene for the patient's protection. When wearing gloves, change them between each patient and wash your hands frequently. Always wear a clean lab coat or gown.

TROUBLESHOOTING GUIDELINES:

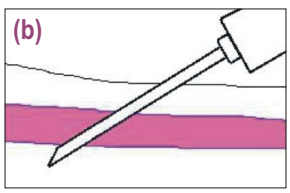
IF AN INCOMPLETE COLLECTION OR NO BLOOD IS OBTAINED:

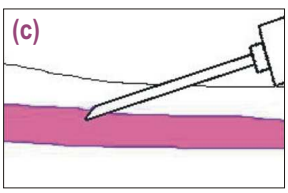
(a) Change the position of the needle. Move it forward (it may not be in the lumen) or (b) move it backward (it may have penetrated too far).

(c) Adjust the angle (the bevel may be against the vein wall).

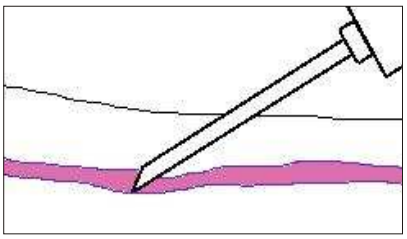


(d) Loosen the tourniquet. It may be obstructing blood flow. (e) Try another tube. There may be no vacuum in the one being used. (f) Re-anchor the vein. Veins sometimes roll away from the point of the needle and puncture site.





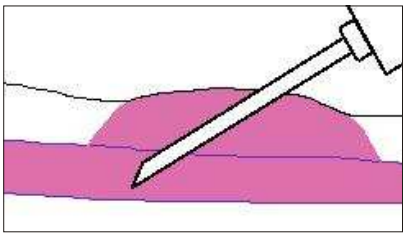
IF BLOOD STOPS FLOWING INTO THE TUBE: The vein may have collapsed; resecure the tourniquet to increase venous filling. If this is not successful, remove the needle, take care of the puncture site, and redraw.



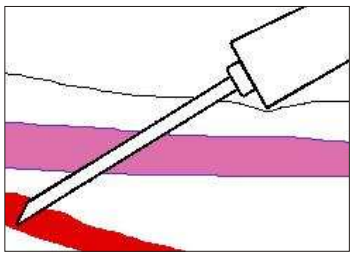
The needle may have pulled out of the vein when switching tubes. Hold equipment firmly and place fingers against patient's arm, using the flange for leverage when withdrawing and inserting tubes.

PROBLEMS OTHER THAN AN INCOMPLETE COLLECTION: A hematoma forms under the skin adjacent to the puncture site - release the tourniquet immediately and withdraw the needle. Apply firm pressure.

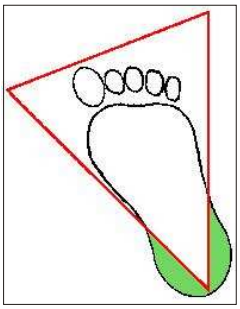
Hematoma formation is a problem in older patients.



The blood is bright red (arterial) rather than venous. Apply firm pressure for more than 5 minutes.



BLOOD COLLECTION ON BABIES:



The recommended location for blood collection on a newborn baby or infant is the heel. The diagram below indicates in green the proper area to use for heel punctures for blood collection: Prewarming the infant's heel (42°C for 3 to 5 minutes) is important to obtain capillary blood gas samples and warming also greatly increases the flow of blood for collection of other specimens. However, do not use too high a temperature warmer, because baby's skin is thin and susceptible to thermal injury. Clean the site to be punctured with an alcohol sponge. Dry the cleaned area with a dry cotton sponge. Hold the baby's foot firmly to avoid sudden movement. Using a sterile blood lancet, puncture the side of the heel in the appropriate regions shown above in green. Do not use the central portion of the heel because you might injure the underlying bone, which is close to the skin surface. Do not use a previous puncture site. Make the cut across the heelprint lines so that a drop of blood can well up and not run down along the lines. Wipe away the first drop of blood with a piece of clean, dry cotton. Since newborns do not often bleed immediately, use gentle pressure to produce a rounded drop of blood. Do not use excessive pressure or heavy massaging because the blood may become diluted with tissue fluid. Fill the capillary tube(s) or micro collection device(s) as needed. When finished, elevate the heel, place a piece of clean, dry cotton on the puncture site, and hold it in place until the bleeding has stopped. Be sure to dispose of the lancet in the appropriate sharps container. Dispose of contaminated materials in appropriate waste receptacles. Remove your gloves and wash your hands.

TULIP NEWS

DRUG ABUSE CASES

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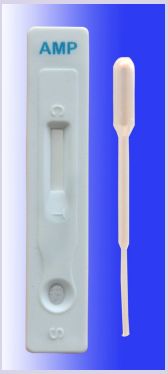

Insight™ Drug of Abuse Panel is available in Single drug format and Multidrug format (Insight™ DOA Panel 6.1) in 10 Test Pack Sizes.

Following table gives an insight to the products available under INSIGHT™ Drug of Abuse range and its utility.

Classification	Drugs	Common Names	Detected by
Opiates	Heroin	Junk, Pata, Horse, Stuff, Skunk, Smack, Brown Sugar	Insight™ | OPI
	Morphine	M, Junk, Morpho, White Stuff, Ganja	
	Codeine	Rabo, School boy, Syrup, Captain Cody	
MTD	Methadone	Methadose	Insight™ | MTD
THC	Marijuana & Cannabinoids	Marijuana, Hashish, Bhang, Sinsemilla, dope, grass, herb, weed	Insight™ | THC
Stimulants	Cocaine	Coke, Crack, Flake, Snow, Rock, Blow, Bump	Insight™ | COC
	Amphetamine	Speed, Bennies, Uppers, Dexies	Insight™ | AMP
	Methamphetamine	Speed, Meth, Crystal, Ice, Crank, go fast, Fire, Glass	Insight™ | MET
Barbiturates	Pentobarbital	Goog balls, Yellow jacket, Submarine	Insight™ | BAR
	Phenobarbital	Barbs, Downer, Candy	
Sedatives	Benzodiazepine	Tranks, Blues, Diazepam, Downer, Sleeping pills	Insight™ | BZO
	Ketamine	Special K, Lady K, Vitamin, Jet	Insight™ | KET

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Fax: (0832) 2458544, E-mail: sales@tulipgroup.com. Website: www.tulipgroup.com