07 - 5.7 Medical Assessment and Laboratory Testing

5.7 Medical Assessment and Laboratory Testing in Psychiatry

T, Lehtonen L, Hallman M, Haataja L. Apolipoprotein E, brain injury and neurodevelopmental outcome of children. Genes Brain Beh. 2013;28(4):435–445. Mattis S, Papolos D, Luck D, Cockerham M, Thode HC Jr. Neuropsychological factors differentiating treated children with pediatric bipolar disorder from those with attention-deficit/hyperactivity disorder. J Clin Experi Neuropsychology. 2010;33:74. Pennington B. Diagnosing Learning Disorders: A Neuropsychological Framework. 2nd ed. New York: Guilford; 2008. Scholle SH, Vuong O, Ding L, Fry S, Gallagher P, Brown JA, Hays RD, Cleary PD. Development of and field test results for the CAHPS PCMH survey. Med Care. 2012;50:S2. Stark D, Thomas S, Dawson D, Talbot E, Bennett E, Starza-Smith A. Paediatric neuropsychological assessment: an analysis of parents' perspectives. Soc Care Neurodisabil . 2014;5:41–50. Williams L, Hermens D, Thein T, Clark C, Cooper N, Clarke S, Lamb C, Gordon E, Kohn M. Using brain-based cognitive measures to support clinical decisions in ADHD. Pediatr Neurol. 2010;42(2):118. 5.7 Medical Assessment and Laboratory Testing in Psychiatry Two recent issues have pushed medical assessment and laboratory testing in psychiatric patients to the forefront of attention for most clinicians: the widespread recognition of the pervasive problem of metabolic syndrome in clinical psychiatry and the shorter life expectancy of psychiatric patients compared with that of the general population. Factors that may contribute to medical comorbidity include abuse of tobacco, alcohol and drugs, poor dietary habits, and obesity. Further, many psychotropic medications are associated with health risks that include obesity, metabolic syndrome, and hyperprolactinemia. Consequently, monitoring the physical health of psychiatric patients has become a more prominent issue. A logical and systematic approach to the use of medical assessment and laboratory testing by the psychiatrist is vital to achieving the goals of arriving at accurate diagnoses, identifying medical comorbidities, implementing appropriate treatment, and delivering cost-effective care. With respect to the diagnosis or management of medical disease, consultation with colleagues in other specialties is important. Good clinicians

recognize the limits of their expertise and the need for consultation with their nonpsychiatric colleagues.

PHYSICAL HEALTH MONITORING Monitoring the physical health of psychiatric patients has two goals: to provide appropriate care for existing illnesses and to protect the patient's current health from possible future impairment. Disease prevention should begin with a clear concept of the condition to be avoided. Ideally, in psychiatry this would be a focus on commonly found conditions that could be a significant source of morbidity or mortality. It is clear that in psychiatry a small number of clinical problems underlie a significant number of impairments and premature deaths. ROLE OF HISTORY AND PHYSICAL EXAMINATION A thorough history, including a review of systems, is the basis for a comprehensive patient assessment. The history guides the clinician in the selection of laboratory studies that are relevant for a specific patient. Many psychiatric patients, owing to their illnesses, are not capable of providing sufficiently detailed information. Collateral sources of information, including family members and prior clinicians and their medical records, may be particularly helpful in the assessment of such patients. The patient's medical history is an important component of the history. It should include notation of prior injuries and, in particular, head injuries that resulted in loss of consciousness and other causes of unconsciousness. The patient's medical history also should note pain conditions, ongoing medical problems, prior hospitalizations, prior surgeries, and a list of the patient's current medications. Toxic exposures are another important component of the medical history. Such exposures are often workplace related. The social history contains many of the details relevant to the assessment of character pathology, including risk factors for personality disorders as well as information relevant to the assessment of major disorders. Commonly, the social history includes a legal history, information about family and other significant relationships, and an occupational history. In evaluating patients who appear demented, the role of the physical examination is to elucidate possible causative factors such as the cogwheel rigidity and tremor associated with Parkinson's disease or neurological deficits suggestive of prior strokes. Standard laboratory studies commonly assessed in dementia patients include a complete blood count (CBC), serum electrolytes, liver function tests, blood urea nitrogen (BUN), creatinine (Cr), thyroid function tests, serum B12 and folate levels, Venereal Disease Research Laboratory (VDRL) test, and a urinalysis. Currently, there is no clear clinical indication for testing for the apolipoprotein E epsilon 4 allele. Often, a computed tomography (CT) scan is performed if there are focal neurological findings, and an electroencephalogram (EEG) may be performed if there is delirium. When patients are delirious, the neurological examination may be complicated by inattention due to altered levels of consciousness. Delirium workup often includes the same laboratory

workup described above for dementia. Urine or blood cultures, chest radiograph, neuroimaging studies, or EEG also may be appropriate. IMAGING OF THE CENTRAL NERVOUS SYSTEM Imaging of the central nervous system (CNS) can be broadly divided into two domains: structural and functional. Structural imaging provides detailed, noninvasive visualization of the morphology of the brain. Functional imaging provides a visualization of the spatial distribution of specific biochemical processes. Structural imaging includes X-ray CT and magnetic resonance imaging (MRI). Functional imaging includes positron emission tomography (PET), single photon emission computed tomography (SPECT), functional MRI (fMRI), and magnetic resonance spectroscopy (MRS). With the limited exception of PET scanning, functional imaging techniques are still considered research tools that are not yet ready for routine clinical use. Magnetic Resonance Imaging MRI scans are used to

distinguish structural brain abnormalities that may be associated with a patient's behavioral changes. These studies provide the clinician with images of anatomical structures viewed from cross-sectional, coronal, or oblique perspectives. MRI scans can detect a large variety of structural abnormalities. The MRI is particularly useful in examining the temporal lobes, the cerebellum, and the deep subcortical structures. It is unique in its ability to identify periventricular white matter hyperintensities. MRI scans are useful in examining the patient for particular diseases, such as nonmeningeal neoplasms, vascular malformations, seizure foci, demyelinating disorders, neurodegenerative disorders, and infarctions. Advantages of MRI include the absence of ionizing radiation and the absence of iodine-based contrast agents. MRI scans are contraindicated when the patient has a pacemaker, aneurysm clips, or ferromagnetic foreign bodies. Computed Tomography CT scans are used to identify structural brain abnormalities that may contribute to a patient's behavioral abnormalities. These studies provide the clinician with crosssectional X-ray images of the brain. CT scans can detect a large variety of structural abnormalities in the cortical and subcortical regions of the brain. CT scans are useful when a clinician is looking for evidence of a stroke, subdural hematoma, tumor, or abscess. These studies also permit visualization of skull fractures. CT scans are the preferred modality when there is suspicion of a meningeal tumor, calcified lesions, acute subarachnoid or parenchymal hemorrhage, or acute parenchymal infarction. CT scans may be performed with or without contrast. The purpose of contrast is to enhance the visualization of diseases that alter the blood–brain barrier, such as tumors, strokes, abscesses, and other infections.

Positron Emission Tomography PET scans are performed predominately at university medical centers. PET scans require a positron emission tomograph (the scanner) and a cyclotron to create the relevant isotopes. This type of scan involves the detection and measurement of emitted positron radiation after the injection of a compound that has been tagged with a positronemitting isotope. Typically, PET scans use fluorodeoxyglucose (FDG) to measure regional brain glucose metabolism. Glucose is the principal energy source for the brain. These scans can provide information about the relative activation of brain regions because regional glucose metabolism is directly proportionate to neuronal activity. Brain FDG scans are useful in the differential diagnosis of dementing disease. The most consistent finding in the PET literature is the pattern of temporal-parietal glucose hypometabolism in patients with Alzheimer's type dementia. PET scanning using FDDNP (2-(1-{6-[(2-[fluorine-18]fluoroethyl)(methyl)amino]-2naphthyl}-ethylidene) malononitrile) has the ability to differentiate between normal aging, mild cognitive impairment, and Alzheimer's disease by determining regional cerebral patterns of plaques and tangles associated with Alzheimer's disease. FDDNP binds to the amyloid senile plaques and tau neurofibrillary tangles. FDDNP appears to be superior to FDG PET in differentiating Alzheimer's patients from those with mild cognitive impairment and subjects with normal aging and no cognitive impairment. Single Photon Emission Computed Tomography SPECT is available in most hospitals but is rarely used to study the brain. SPECT is more commonly used to study other organs, such as the heart, liver, and spleen. Some recent work, however, attempts to correlate SPECT brain imaging with mental disorders. Functional Magnetic Resonance Imaging fMRI is a research scan used to measure regional cerebral blood flow. Often, fMRI data are superimposed on conventional MRI images, resulting in detailed brain maps of brain structure and function. The measurement of blood flow involves the use of the heme molecule as an endogenous contrast agent. The rate of flow of heme molecules can be measured, resulting in an assessment of regional cerebral metabolism. Magnetic Resonance Spectroscopy MRS is another research method to measure regional brain metabolism.

MRS scans are performed on conventional MRI devices that have had specific upgrades to their hardware and software. The upgrades permit the signal from protons to be suppressed and other compounds to be measured. (Conventional MRI images are, in reality, a map of the spatial distribution of protons found in water and fat.) Magnetic Resonance Angiography

Magnetic resonance angiography (MRA) is a method for creating three-dimensional maps of cerebral blood flow. Neurologists and neurosurgeons more commonly use this test. It is rarely used by psychiatrists. TOXICOLOGY STUDIES Urine drugs of abuse screens are immunoassays that detect barbiturates, benzodiazepines, cocaine metabolites, opiates, phencyclidine, tetrahydrocannabinol, and tricyclic antidepressants. These rapid tests provide results within an hour. However, they are screening tests; additional testing is required to confirm the results of this screening. Testing to determine blood concentrations of certain psychotropic medications enables the clinician to ascertain whether blood levels of medications are at therapeutic, subtherapeutic, or toxic levels. Psychiatric symptoms are not uncommon when prescribed medications are at toxic levels. In the debilitated and the elderly, pathological symptoms may occur at therapeutic concentrations. The normal reference range varies between laboratories. It is important to check with the laboratory performing the test to obtain the normal reference range for that laboratory. Testing for drugs of abuse is usually performed on urine specimens. It also may be performed on specimens of blood, breath (alcohol), hair, saliva, and sweat. Urine screens provide information about recent use of frequently abused drugs such as alcohol, amphetamines, cocaine, marijuana, opioids, and phencyclidine along with 3,4methylenedioxymethamphetamine (MDMA) (ecstasy). Many substances may produce false positives with urine drug screening tests. When a false positive is suspected, a confirmatory test may be requested. Comprehensive qualitative toxicology screening is usually performed by liquid and gas chromatography. This may require many hours to perform and is rarely done in routine clinical situations. It is usually performed in patients with unexplained toxicity and an atypical clinical picture. Qualitative toxicology assessments may be useful in managing patients who have overdosed, when combined with clinical assessment and knowledge of when the ingestion occurred. Drug Abuse Patients are frequently unreliable when reporting their drug abuse history. Drug-induced mental disorders often resemble primary psychiatric disorders. Furthermore, substance abuse can exacerbate preexisting mental illness. Indications for ordering a drug abuse screen include unexplained behavioral symptoms, a history of illicit drug use or dependence in a new patient evaluation, or a high-risk background (e.g., criminal record, adolescents, and prostitutes). A drug abuse screen is also frequently used to monitor patient abstinence during treatment of substance abuse. Such tests can be ordered on a scheduled or random basis. Many clinicians believe random testing may be more accurate in the assessment of abstinence. The tests also may help to motivate the

patient. Other laboratory data may suggest a problem with substance abuse. An increase in the mean corpuscular volume is associated with alcohol abuse. Liver enzymes may be increased with alcohol abuse or from hepatitis B or C acquired from intravenous (IV) drug abuse. Serological testing for hepatitis B or C can confirm that diagnosis. IV drug abusers are at risk for bacterial endocarditis. If bacterial endocarditis is suspected, further medical workup is indicated. Tested Substances. Routine tests are available for phencyclidine (PCP), cocaine, tetrahydrocannabinol (THC; also known as marijuana), benzodiazepines, methamphetamine and its metabolite amphetamine, morphine (Duramorph), codeine, methadone (Dolophine), propoxyphene (Darvon), barbiturates, lysergic acid diethylamide (LSD), and MDMA. Drug screening tests may have high

false-positive rates. This is often due to the interaction of prescribed medication with the test, resulting in false-positive results and lack of confirmatory testing. False-negative tests are common as well. False-negative results may be due to problems with specimen collection and storage. Testing is most commonly performed on urine, although serum testing is also possible for most agents. Hair and saliva testing are also available in some laboratories. Alcohol can also be detected in the breath (breathalyzer). With the exception of alcohol, drug levels are not usually determined. Instead, only the presence or absence of the drug is determined. There is usually not a meaningful or useful correlation between the level of the drug and clinical behavior. The length of time that a substance can be detected in the urine is listed in Table 5.7-1. Table 5.7-1 Drugs of Abuse that Can Be Detected in Urine Alcohol There is no single test or finding on physical examination that is diagnostic for alcohol abuse. The history of the pattern of alcohol ingestion is most important in making the diagnosis. Laboratory test results and findings on physical examination may help to

confirm the diagnosis. In patients with acute alcohol intoxication, a blood alcohol level (BAL) may be useful. A high BAL in a patient who clinically does not show significant intoxication is consistent with tolerance. Significant clinical evidence of intoxication with a low BAL should suggest intoxication with additional agents. Intoxication is commonly found with levels between 100 and 300 mg/dL. The degree of alcohol intoxication can also be assessed using the concentration of alcohol in expired respirations (breathalyzer). Chronic alcohol use is commonly associated with other laboratory abnormalities, including elevation in liver enzymes, such as aspartate aminotransferase (AST), which is usually greater than serum alanine aminotransferase (ALT). Bilirubin also is often elevated. Total protein and albumin may be low, and prothrombin time (PT) may be increased. A macrocytic anemia may be present. Alcohol abuse may be associated with rhinophyma, telangiectasias, hepatomegaly, and evidence of trauma on physical examination. In withdrawal, patients may have hypertension, tremulousness, and tachycardia. Laboratory studies in patients who abuse alcohol may reveal macrocytosis. This occurs in most patients who consume four or more drinks per day. Alcoholic liver disease is characterized by elevations in AST and ALT, typically in a ratio of AST to ALT of 2:1 or greater. The γ-glutamyl transpeptidase (GGT) level may be elevated. Carbohydratedeficient transferrin (CDT) may be helpful in the identification of chronic heavy alcohol use. It has a sensitivity of 60 to 70 percent and a specificity of 80 to 90 percent. BAL is used to legally define intoxication in the determination of whether an individual is driving under the influence. The legal limit in many states is 80 mg/dL. However, clinical manifestations of intoxication vary with an individual’s degree of alcohol tolerance. At the same BAL, an individual who chronically abuses alcohol may exhibit less impairment than an alcohol-naive individual. Generally a BAL in the range of 50 to 100 mg/dL is associated with impaired judgment and coordination, and levels greater than 100 mg/dL produce ataxia. Environmental Toxins Specific toxins are associated with a variety of behavioral abnormalities. Exposure to toxins commonly occurs through occupation or hobbies. Aluminum intoxication can cause a dementia-like condition. Aluminum can be detected in the urine or blood. Arsenic intoxication may cause fatigue, loss of consciousness, anemia, and hair loss. Arsenic can be detected in urine, blood, and hair. Manganese intoxication may present with delirium, confusion, and a parkinsonian syndrome. Manganese may be detected in urine, blood, and hair. Symptoms of mercury intoxication include apathy, poor memory, lability, headache, and fatigue. Mercury can be detected in urine, blood, and hair. Manifestations of lead intoxication include encephalopathy, irritability, apathy, and anorexia. Lead can be detected in blood or urine. Lead levels typically are

assessed by collecting a 24-hour urine sample. The free erythrocyte protoporphyrin test is a screening test for chronic lead intoxication. This test is commonly coupled with a blood lead level. The Centers for Disease Control and Prevention specify that a lead level greater than 25 µg/dL is significant for children. The incidence of lead toxicity in children has been falling recently. Significant exposure to organic compounds, such as insecticides, may produce behavioral abnormalities. Many insecticides have strong anticholinergic effects. There are no readily available laboratory tests to detect these compounds. Poison control centers may assist in the identification of appropriate testing facilities. Volatile Solvent Inhalation Volatile substances produce vapors that are inhaled for their psychoactive effect. The most commonly abused volatile solvents include gasoline, glue, paint thinner, and correction fluid (white-out). The aerosol propellants from cleaning sprays, deodorant sprays, and whipped cream containers may be abused. Nitrites, such as amyl nitrite (“poppers”) and butyl nitrite vials (“rush”), and anesthetic gases, such as chloroform, ether, and nitrous oxide, are also abused. Chronic abuse of volatile solvents is associated with damage to the brain, liver, kidneys, lung, heart, bone marrow, and blood. Abuse may produce hypoxia or anoxia. Signs of abuse include short-term memory loss, cognitive impairment, slurred and “scanning” speech, and tremor. Cardiac arrhythmias may occur. Exposure to toluene, which is present in many cleaning solutions, paints, and glues, has been associated with loss of clear gray–white matter differentiation and with brain atrophy on MRI scans. Methemoglobinemia has occurred with butyl nitrite abuse. Chronic use of volatile solvents is associated with the production of panic attacks and an organic personality disorder. Chronic use may also produce impairment in working memory and executive cognitive function. SERUM MEDICATION CONCENTRATIONS Serum concentrations of psychotropic medications are assessed to minimize the risk of toxicity to patients receiving these medications and to ensure the administration of amounts sufficient to produce therapeutic response. This is particularly true for medications with therapeutic blood levels. Medication levels are often influenced by hepatic metabolism. This metabolism occurs via the action of enzymes in the liver. Acetaminophen Acetaminophen may produce hepatic necrosis, which in some cases may be fatal. Acetaminophen is one of the most frequently used agents in intentional drug overdoses and is a common cause of overdose-related deaths. Toxicity is associated with levels greater than 5 mg/dL (>330 µmol/L) in patients without preexisting liver disease. Chronic abusers of alcohol are particularly vulnerable to the effects of overdose.

Acetylcysteine (Mucomyst) treatment must occur promptly after overdose to prevent hepatotoxicity. Salicylate Toxicity Aspirin is frequently ingested in overdose. Consequently, serum salicylate levels often are obtained in overdose cases. Some rheumatic patients may chronically ingest large amounts of salicylate for therapeutic reasons. Ingestion of 10 to 30 g of aspirin may be fatal. Most patients will develop symptoms of toxicity when salicylate levels are greater than 40 mg/dL (2.9 mmol/L). Common symptoms of toxicity include acid-base abnormalities, tachypnea, tinnitus, nausea, and vomiting. In cases of severe toxicity, symptoms may include hyperthermia, altered mental status, pulmonary edema, and death. Antipsychotic Agents Clozapine. Clozapine (Clozaril) levels are trough levels determined in the morning before administration of the morning dose of medication. A therapeutic range for clozapine has not been established; however, a level of 100 mg/mL is widely considered to be the minimum therapeutic threshold. At least 350 mg/mL of clozapine is considered to be necessary to achieve therapeutic response in patients with refractory schizophrenia. The likelihood of seizures and other side effects increases with clozapine levels greater than 1,200 mg/mL or doses greater than 600 mg per day or both. Clozapine is a common cause of a leukopenia in psychiatry. When moderate to severe leucopenia develops, clozapine

treatment must be interrupted, but patients may be retreated with clozapine in the future. Mood Stabilizers Carbamazepine. Carbamazepine (Tegretol) may produce changes in the levels of white blood cells, platelets, and, under rare circumstances, red blood cells. Anemia, aplastic anemia, leucopenia, and thrombocytopenia may all occur but are rare. Pretreatment evaluations typically include CBC. Carbamazepine may produce hyponatremia. This hyponatremia is usually mild and does not produce clinical symptoms. However, carbamazepine may cause the syndrome of inappropriate secretion of antidiuretic hormone (SIADH). Carbamazepine may produce a variety of congenital abnormalities, including spina bifida and anomalies of the fingers. Manifestations of toxicity may include nausea, vomiting, urinary retention, ataxia, confusion, drowsiness, agitation, or nystagmus. At very high levels, symptoms may also include cardiac dysrhythmias, seizures, and respiratory depression. Lithium. Lithium (Eskalith) has a narrow therapeutic index. Consequently, blood levels of lithium must be monitored to achieve therapeutic dosing and avoid toxicity.

Side effects are dose dependent. Symptoms of toxicity include tremors, sedation, and confusion. At higher levels delirium, seizures, and coma may occur. Symptoms of toxicity may begin to manifest with serum levels of greater than 1.2 mEq/L and are common with levels greater than 1.4 mEq/L. Elderly or debilitated patients may show signs of toxicity with levels less than 1.2 mEq/L. Valproate. Because of the risk of hepatotoxicity, ranging from mild dysfunction to hepatic necrosis, pretreatment liver function tests are usually obtained. More commonly valproate (valproic acid [Depakene] and divalproex [Depakote]) may cause a sustained elevation in liver transaminase levels of as much as three times the upper limit of normal. Valproate may increase the risk of birth defects. A pretreatment urine pregnancy test is usually obtained in women of childbearing years. Women should be cautioned to use adequate contraception. Hematological abnormalities are also possible and include leucopenia and thrombocytopenia. Treatment with valproate may increase serum ammonia levels. It is prudent to obtain an ammonia level in a patient undergoing valproate treatment who presents with altered mental status or lethargy. Acute pancreatitis may also occur. Antidepressants Monoamine Oxidase Inhibitors. Treatment with monamine oxidase inhibitors (MAOIs) can cause orthostasis and, rarely, hypertensive crisis. Baseline blood pressure measurement should be obtained before the initiation of treatment, and blood pressure should be monitored during treatment. There are no meaningful blood levels for MAOIs, and direct monitoring of MAOI blood levels is not clinically indicated. Treatment with MAOIs is occasionally associated with hepatotoxicity. For this reason, liver function tests usually are obtained at the initiation of treatment and periodically after. Tricyclic and Tetracyclic Antidepressants. Routine laboratory studies obtained before initiation of tricyclic or tetracyclic antidepressants (TCAs) typically include CBC, serum electrolytes, and liver function tests. Because TCAs affect cardiac conduction, clinicians also may obtain an electrocardiogram (ECG) to assess for the presence of abnormal cardiac rhythms and prolonged PR, QRS, and QTc complexes before initiation of these medication. NEUROLEPTIC MALIGNANT SYNDROME Neuroleptic malignant syndrome (NMS) is a rare, potentially fatal, consequence of neuroleptic administration. The syndrome consists of autonomic instability, hyperpyrexia, severe extrapyramidal symptoms (i.e., rigidity), and delirium. Sustained muscle contraction results in peripheral heat generation and muscle breakdown. Muscle breakdown contributes to elevated levels of creatine kinase (CK). Peripheral heat

generation with impaired central mechanisms of thermoregulation results in hyperpyrexia. Myoglobinuria and leukocytosis are common. Hepatic and renal failure may occur. Liver enzymes become elevated with liver failure. Patients may die from hyperpyrexia, aspiration pneumonia,

renal failure, hepatic failure, respiratory arrest, or cardiovascular collapse. Treatment includes discontinuation of the neuroleptic, hydration, administration of muscle relaxants, and general supportive nursing care. A typical laboratory workup for NMS includes a CBC, serum electrolytes, BUN, Cr, and CK. A urinalysis, including an assessment of urine myoglobin, is also usually performed. As part of the differential diagnosis, blood and urine cultures are performed as part of a fever workup. Pronounced elevations in the white blood cell (WBC) count may occur in NMS. White blood cell counts are typically in the range from 10,000 to 40,000 per mm3. Muscle Injury Serum CK levels may rise in response to repeated intramuscular (IM) injections, prolonged or agitated periods in restraint, or NMS. Dystonic reactions from neuroleptic administration may also result in elevated levels of CK. ELECTROCONVULSIVE THERAPY Electroconvulsive therapy (ECT) is usually reserved for patients with the most treatment-resistant depression. Typical laboratory tests obtained before the administration of ECT include a CBC, serum electrolytes, urinalysis, and liver function tests. However, no specific laboratory tests are required in the pre-ECT evaluation. Usually, an ECG is also obtained. A spinal X-ray series is no longer considered routinely indicated because of the low risk of spinal injury associated with modern administration techniques that use paralyzing agents. A comprehensive medical history and physical examination are useful screening tools to identify possible conditions that could complicate treatment. ENDOCRINE EVALUATIONS Endocrine disease is of great relevance to psychiatry. Management of psychiatric illness is complicated by comorbid endocrine disease. Endocrine illness frequently has psychiatric manifestations. For these reasons, screening for endocrine disease is often of relevance to the psychiatrist. Adrenal Disease Adrenal disease may have psychiatric manifestations, including depression, anxiety, mania, dementia, psychosis, and delirium. However, patients with adrenal disease rarely come to the attention of psychiatrists. Assessment and management of these patients are best done in conjunction with specialists.

Low plasma levels of cortisol are found in Addison’s disease. These patients may have symptoms that are also common in psychiatric conditions including fatigue, anorexia, weight loss, and malaise. Patients may also have memory impairment, confusion, or delirium. Depression or psychosis with hallucinations and delusions may occur. Elevated levels of cortisol are seen in Cushing’s syndrome. About half of all patients with Cushing’s syndrome develop psychiatric symptoms. These symptoms may include lability, irritability, anxiety, panic attacks, depressed mood, euphoria, mania, or paranoia. Cognitive dysfunctions may include cognitive slowing and poor short-term memory. Symptoms usually improve when cortisol normalizes. If not, or if symptoms are severe, psychiatric treatment may be necessary. Cortisol levels have not been found to be useful in the assessment or management of primary psychiatric disease. In particular, the dexamethasone-suppression test (DST) remains a research tool in psychiatry that is not used in routine clinical care. Anabolic Steroid Use Use of anabolic steroids has been associated with irritability, aggression, depression, and psychosis. Athletes and bodybuilders are common abusers of anabolic steroids. Urine specimens can be used to screen for these agents. Because so many compounds have been synthesized, a variety of tests may be required to confirm the diagnosis, depending on the compound that has been used. Consultation with a specialist is advised. Generally, androgens other than testosterone can be detected by gas chromatography and mass spectroscopy. Antidiuretic Hormone Arginine vasopressin (AVP), also called antidiuretic hormone (ADH), is decreased in central diabetes insipidus (DI). DI may be central (due to the pituitary or hypothalamus) or nephrogenic. Nephrogenic DI may be acquired or due to an inherited X-linked condition. Lithium-induced DI is an example of an acquired form of DI. Lithium has been shown to

decrease the sensitivity of renal tubules to AVP. Patients with central DI respond to the administration of vasopressin with a decrease in urine output. Secondary central DI may develop in response to head trauma that produces damage in the pituitary or hypothalamus. About one-fifth of patients taking lithium develop polyuria, and a larger amount may have some degree of impairment in concentrating urine. Chronic treatment with lithium is a common cause of nephrogenic DI. However, there are other causes of polyuria in lithium-treated patients in addition to nephrogenic DI. Primary polydipsia is common and is often associated with the dry mouth associated with many psychiatric medications. Central diabetes has also been associated with lithium treatment. Excessive secretion of AVP results in increased retention of fluid in the body. This condition is called SIADH. Water retention in SIADH causes hyponatremia. SIADH may develop in response to injury to the brain or from medication administration (including phenothiazines, butyrophenones, carbamazepine, and oxcarbazepine). The hyponatremia associated with this condition may produce delirium. Human Chorionic Gonadotropin

Human chorionic gonadotropin (hCG) can be assessed in the urine and blood. The urine test for hCG is the basis for the commonly used urine pregnancy test. This immunometric test is able to detect pregnancy approximately 2 weeks after an expected menstrual period has passed. Routine tests are most accurate when performed 1 to 2 weeks after a missed period and are not reliably accurate until the 2-week period has passed. However, there are ultrasensitive urine hCG tests that can accurately detect pregnancy 7 days after fertilization. Pregnancy tests often are obtained before initiating certain psychotropic medications, such as lithium, carbamazepine, and valproate, which are associated with congenital anomalies. Parathormone Parathormone (parathyroid hormone) modulates serum concentrations of calcium and phosphorus. Dysregulation in this hormone and the resulting production of abnormalities in calcium and phosphorus may produce depression or delirium. Prolactin Prolactin levels may become elevated in response to the administration of antipsychotic agents. Elevations in serum prolactin result from the blockade of dopamine receptors in the pituitary. This blockade produces an increase in prolactin synthesis and release. Cerebral MRI is not usually performed if the patient is taking an antipsychotic drug known to cause hyperprolactinemia, and the magnitude of the prolactin elevation is consistent with drug-induced causes. Prolactin levels may briefly rise after a seizure. For this reason, prompt measurement of a prolactin level after possible seizure activity may assist in differentiating a seizure from a pseudoseizure. Thyroid Hormone Disease of the thyroid is associated with many psychiatric manifestations. Thyroid disease is most commonly associated with depression and anxiety but may also give rise to symptoms of panic, dementia, and psychosis. Thyroid disease may mimic depression. It is difficult to achieve euthymia if a patient is not euthyroid. Systemic Lupus Erythematosus Systemic lupus erythematosus (SLE) is an autoimmune disorder. Tests for SLE are based on the detection of antibodies formed as part of the disease. Antinuclear antibodies are found in virtually all patients with SLE. Antibody levels also are used to monitor the severity of the illness. A fluorescent test is used to detect the antinuclear antibodies. This test can be positive in a variety of rheumatic diseases. For this reason, a positive result usually is followed by additional tests, including a test to detect anti-deoxyribonucleic acid (DNA) antibodies. Anti-DNA antibodies, when associated with antinuclear antibodies, are strongly suggestive of a diagnosis of lupus. Anti-DNA antibodies are followed to monitor the response to treatment.

Psychiatric manifestations of lupus include depression, dementia, delirium, mania, and psychosis. About 5 percent of patients with lupus present with symptoms of psychosis including hallucinations

and delusions. Pancreatic Function Measurement of serum amylase is used to monitor pancreatic function. Elevations in amylase levels may occur in alcohol-abusing patients who develop pancreatitis. Serum amylase levels also may be fractionated into salivary and pancreatic components. CLINICAL CHEMISTRY Serum Electrolytes Serum electrolyte levels may be useful in the initial evaluation of a psychiatric patient. Levels of serum electrolytes often are abnormal in patients with delirium. Abnormalities also may occur in response to the administration of psychotropic medications. Low serum chloride levels may occur in eating disorder patients who purge by self-induced vomiting. Serum bicarbonate levels may be elevated in patients who purge or who abuse laxatives. Bicarbonate levels are commonly low in patients who hyperventilate in response to anxiety. Hypokalemia may be present in eating disorder patients who purge or abuse laxatives and in psychogenic vomiting. Diuretic abuse by eating disorder patients also may produce hypokalemia. Low levels of potassium are associated with weakness and fatigue. Characteristic ECG changes occur with hypokalemia and consist of cardiac arrhythmias, U waves, flattened T waves, and ST-segment depression. Eating disorder patients with anorexia nervosa or bulimia nervosa usually receive a fairly standard set of laboratory studies, including serum electrolytes (particularly potassium and phosphorus), blood glucose, thyroid function tests, liver enzymes, total protein, serum albumin, BUN, Cr, CBC, and ECG. Serum amylase is often assessed in bulimic patients. Magnesium levels may be low in alcohol-abusing patients. Low magnesium levels are associated with agitation, confusion, and delirium. If untreated, convulsions and coma may follow. Low levels of serum phosphorus may be present in eating disorder patients with purging behavior. Phosphorus levels may also be low in anxiety patients who hyperventilate. Hyperparathyroidism may produce low serum phosphorus levels. Elevated serum phosphorus levels are seen in hypoparathyroidism. Hyponatremia is seen in psychogenic polydipsia and SIADH and in response to certain medications, such as carbamazepine. Low sodium levels are associated with delirium. Serum calcium abnormalities are associated with a variety of behavioral abnormalities. Low serum calcium levels are associated with depression, delirium, and irritability. Elevated levels are associated with depression, psychosis, and weakness.

Laxative abuse, common in eating disorder patients, can be associated with hypocalcemia. Hypocalcemia secondary to hypoparathyroidism may occur in patients who have undergone surgery for thyroid disease. Serum copper levels are low in Wilson’s disease, a rare abnormality in copper metabolism. Copper is deposited in the brain and liver, resulting in decreased intellectual functioning, personality changes, psychosis, and a movement disorder. Symptoms are usually present in the second and third decades of life. Laboratory assessment for Wilson’s disease includes the measurement of serum ceruloplasmin, the transport protein for copper, which is low, and urine copper, measured in a 24-hour specimen, which is elevated. Renal Function Tests of renal function include BUN and Cr. Other relevant laboratory studies include the routine urinalysis and Cr clearance. An elevated BUN often results in lethargy or delirium. BUN commonly is elevated with dehydration. Elevations in BUN often are associated with impaired clearance of lithium. A less sensitive index of renal function is Cr. Elevations in Cr may indicate extensive renal impairment. Elevated levels occur when approximately 50 percent of the nephrons are damaged. Cr clearance is often assessed in patients taking lithium. It is a sensitive measurement of renal function. The test is performed in a well-hydrated patient by collecting all of the patient’s urine for 24 hours. During the midpoint of the 24-hour collection period, a serum Cr level also is obtained. The resulting data are used to calculate the patient’s Cr clearance. Usually, the laboratory performs the calculation. Elevated levels of porphobilinogen are found in the urine of symptomatic patients with acute

intermittent porphyria. Symptoms of this disease include psychosis, apathy, or depression, along with intermittent abdominal pain, neuropathy, and autonomic dysfunction. If urine porphobilinogen levels are elevated when the patient is symptomatic, collection of a 24-hour urine specimen for quantitative assessment of porphobilinogen and aminolevulinic acid is indicated. Liver Function Liver function tests (LFTs) commonly include the serum aminotransferases, alkaline phosphatase, γ-glutamyl transpeptidase and tests of synthetic function, usually the serum albumin concentration and prothrombin time, and the serum bilirubin, which reflects hepatic transport capability. Elevations in AST may occur with diseases of the liver, heart, lungs, kidneys, and skeletal muscle. In patients with alcohol-induced liver disease, AST typically is more elevated than ALT. In viral- and drug-induced liver disease, ALT is often elevated. Serum GGT is elevated in hepatobiliary disease, including alcohol-induced liver disease and cirrhosis. Alkaline phosphatase elevations occur in many diseases, including diseases of the liver, bone, kidney, and thyroid. Levels of alkaline phosphatase may be elevated in

response to some psychiatric medications, most notably the phenothiazines. Serum ammonia levels are often elevated in patients with hepatic encephalopathy. High levels are associated with the delirium of hepatic encephalopathy. Serum ammonia levels also may be elevated in patients undergoing treatment with valproate. Serum bilirubin is an index of hepatic and bile duct function. Prehepatic, unconjugated, or indirect bilirubin and posthepatic, conjugated, or direct bilirubin are often assessed to help elucidate the origin of the elevation in bilirubin. Lactate dehydrogenase (LDH) may be elevated in diseases of the liver, skeletal muscle, heart, and kidney. It is also elevated in pernicious anemia. Vitamins Folate and B12. Folate and B12 deficiencies are common in patients who abuse alcohol. Folate and B12 deficiencies are associated with dementia; delirium; psychosis, including paranoia; fatigue; and personality change. Folate and B12 can be directly measured. Low folate levels may be found in patients who use contraceptive pills or other forms of estrogen, who drink alcohol, or who take phenytoin (Dilantin). INFECTIOUS DISEASE TESTING Testing for sexually transmitted diseases (STDs) has become common, given the current frequency of these diseases. Some psychiatric illnesses, such as mania and substance abuse, are associated with a higher risk of contracting STDs. STDs include herpes simplex virus types 1 and 2, chlamydia, hepatitis viruses, gonorrhea, syphilis, and human immunodeficiency virus (HIV). Risk factors for STD include contact with sex workers, drug abuse, prior history of STDs, meeting partners on the Internet, multiple sex partners, a new sex partner, and being young or unmarried. Other diseases to think about are Epstein-Barr virus and gonorrhea. Intravenous Drug Use The IV route is used for many substances of abuse. Most commonly, heroin, amphetamines, and cocaine are used alone or in combination via the IV route. Because needles often are contaminated, IV drug users are at risk for bacterial endocarditis, hepatitis B and C, HIV infection, and acquired immunodeficiency syndrome (AIDS) from HIV infection. It has been estimated that over 60 percent of new cases of hepatitis C occur in individuals with a history of injecting illicit drugs. CBC and Serum Blood Cultures. The use of contaminated needles or nonsterile injection sites places IV drug users at risk for bacterial infections, including abscesses, bacteremia, and bacterial endocarditis. Findings on physical examination suggestive of endocarditis, possible bacteremia, or abscess necessitate obtaining a CBC to rule out an elevated WBC count. Blood cultures should be obtained from at least two different sites

if the patient is febrile or if findings are suggestive of bacteremia or endocarditis, and internal medicine consultation should be obtained. Syphilis The fluorescent treponemal antibody absorption

(FTA-ABS) test detects antibody against Treponema pallidum spirochetes and is more sensitive and specific than nontreponemal tests for syphilis. The test is used to confirm positive screening tests for syphilis, such as the rapid plasma reagin (RPR) test and the VDRL test. The FTA-ABS test is also used when neurosyphilis is suspected. Once positive, a patient usually remains so for life. False-positive results may occur in patients with SLE. Viral Hepatitis Several types of viruses can cause viral hepatitis. Viral hepatitis produces abnormalities in LFTs including elevation of liver enzymes, especially ALT. Symptoms range from mild flu-like manifestations to rapidly progressive and fatal liver failure. Psychiatric manifestations include depression, anxiety, weakness, and psychosis. Viral hepatitis can also impair the metabolism of psychotropic medications that are metabolized by the liver. Impaired liver metabolism requires an adjustment of the dose of medications metabolized by the liver or consideration of agents that are less affected by alterations in liver metabolism. Viruses causing hepatitis include: hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), and hepatitis D virus (HDV) (delta agent). The WBC is normal to low in patients with hepatitis, especially in the preicteric phase. Large atypical lymphocytes occasionally are present. Rarely, aplastic anemia follows an episode of acute hepatitis not caused by any of the known hepatitis viruses. Mild proteinuria is common, and bilirubinuria often precedes the appearance of jaundice. Acholic stools frequently are present during the icteric phase. Strikingly elevated AST or ALT occurs early, followed by elevations of bilirubin and alkaline phosphatase. In a minority of patients, elevations of bilirubin and alkaline phosphatase persist after aminotransferase levels have normalized. Cholestasis may be substantial in acute hepatitis A. Marked prolongation of the PT in severe hepatitis correlates with increased mortality. Chronic hepatitis, characterized by elevated aminotransferase levels for more than 6 months, develops in 1 to 2 percent of immunocompetent adults with acute hepatitis B. More than 80 percent of all persons with acute hepatitis C develop chronic hepatitis, which, in many cases, progresses slowly. Ultimately, cirrhosis develops in as many as 30 percent of those with chronic hepatitis C and 40 percent of those with chronic hepatitis B; the risk of cirrhosis is even higher in patients coinfected with both viruses or with HIV. Patients with cirrhosis are at risk, with a rate of 3 to 5 percent per year, of hepatocellular carcinoma. Even in the absence of cirrhosis, patients with chronic hepatitis B—particularly those with active viral replication—are at an increased risk.

ELECTROENCEPHALOGRAM The EEG assesses regional cerebral cortical electrical activity. Clinical neuroscience has a long history of using the EEG. The EEG can be used in different ways to study specific brain states or activities by modifications to the technique of data collection or to the data themselves. EEG data can be displayed on paper tracings in the manner of conventional EEG recordings. Alternatively, the data can be digitized, and the digitized data can be transformed, often using a Fourier transformation, to yield color-coded topographic brain maps of regional activity. The collection periods can be prolonged, and the data can be electronically displayed along with video monitoring of the patient to provide telemetry assessments of patients with epilepsy. Telemetry assessments are typically performed in an effort to correlate behavioral abnormalities with brain electrical activity as part of the workup of seizure disorders. Prolonged periods of EEG recording during sleep, when coupled with recording of a limited lead ECG and facial muscle activity, result in the sleep EEG or polysomnography. Many clinicians also use the EEG to monitor ECT administration. Clinicians use the EEG to localize seizure foci and to evaluate delirium. The EEG and its topographical descendents have not found a clear role in the diagnostic assessment of psychiatric patients. The EEG is usually used in psychiatry to rule out nonpsychiatric disease, such as seizure disorders or delirium, as a cause of psychiatric symptoms. When the

differential diagnosis includes strokes, tumors, subdural hematomas, or dementia, the yield is usually higher with imaging tests. Not surprisingly, the yield is the highest in patients with a history of a seizure disorder or a clinical history that is strongly suggestive of a recent seizure or other organic illness. Such clinical features would include a history of altered consciousness, atypical hallucinations (e.g., olfactory), head injury, and automatism. In addition, the EEG is commonly obtained when there is an abnormal CT or MRI. It is important to remember that seizures are a clinical diagnosis; a normal EEG does not rule out the possibility of a seizure disorder. Evoked Potential Evoked potential (EP) testing is the measurement of the EEG response to specific sensory stimulation. The stimulation may be visual, auditory, or somatosensory. During visual EPs, the patient is exposed to flashing lights or a checkerboard pattern. With auditory EP, the patient hears a specific tone. In somatosensory EP, the patient experiences an electrical stimulation to an extremity. These stimuli occur repeatedly while the patient undergoes a routine EEG. Using a computer, the responses to these stimuli are recorded and averaged. The time frame is measured in milliseconds. These tests are useful in neurology and neurosurgery. For example, they assist in the assessment of demyelinating disorders such as multiple sclerosis (MS). In psychiatry, EP testing may help in the differentiation of organic from functional impairments. A classical example is the use of EP testing to evaluate possible hysterical blindness. The usefulness of these tests in psychiatry is still under investigation.

Polysomnography Polysomnography is used to assess disorders of sleep by concurrently assessing the EEG, ECG, blood oxygen saturation, respirations, body temperature, electromyogram, and electro-oculogram. Polysomnography has demonstrated an increase in the overall amount of rapid eye movement (REM) sleep and a shortened period before the onset of REM sleep (decreased REM latency) in patients with major depression. These studies may assist in differentiating depression from other conditions that mimic depression. For example, patients who appear depressed from dementia do not have a decreased REM latency or an increase in the amount of REM sleep. ELECTROCARDIOGRAM The ECG is a graphical representation of the electrical activity of the heart. Abnormalities in this activity correlate with cardiac pathology. The ECG is most commonly used in psychiatry to assess side effects of psychotropic medications. Ziprasidone (Geodon) has been associated with a dose-related prolongation of the QTc interval. There is a known association of fatal arrhythmias (e.g., torsades de pointes) with QTc prolongation from some other medications. For this reason, clinicians usually obtain an ECG before initiation of treatment with ziprasidone. Ziprasidone is contraindicated in patients with a known history of QTc prolongation (including congenital long QT syndrome), with recent acute myocardial infarction, or with uncompensated heart failure. Bradycardia, hypokalemia or hypomagnesemia, or the concurrent use of other drugs that prolong the QTc interval all increase the risk for serious arrhythmias. Ziprasidone should be discontinued in patients who have persistent QTc measurements greater than 500 milliseconds. Like ziprasidone, thioridazine (Mellaril) has been associated with prolongation of the QTc interval in a dose-related manner. Prolongation of the QTc interval has been associated with torsades de pointes arrhythmias and sudden death. An ECG should be obtained before initiating treatment with thioridazine to rule out QTc prolongation. TCAs are, at times, associated with ECG changes. Anticholinergic effects may increase heart rate. Prolongation of the PR, QT, and QRS intervals, along with ST-segment and T-wave abnormalities, may occur. The TCAs can cause or increase preexisting atrioventricular or bundle branch block. When the QTc exceeds 0.440 second, a patient is at an increased risk for sudden death due to cardiac arrhythmias. Many clinicians obtain an ECG before beginning a TCA in a patient older than 40 years of age and in any patient with known

cardiovascular disease. Lithium therapy can cause benign reversible T-wave changes, can impair sinoatrial (SA) node function, and can cause heart block. ECGs are often obtained before initiation of treatment with lithium and in cases of lithium toxicity or overdose. Psychiatrists, when treating patients with certain psychiatric diagnoses, also use the ECG. Eating disorder patients commonly have low potassium levels that may result in abnormal ECG recordings. As the serum potassium drops below normal, T waves become

flat (or inverted), and U waves may appear. Holter Monitoring Holter monitoring is the continuous recording of a patient's ECG activity for a sustained time period (e.g., 24 hours). Patients are ambulatory during this time. It is useful for the evaluation of dizziness, palpitations, and syncope. It is commonly used in the evaluation of patients with panic disorder who manifest cardiac symptoms. Cardiac Ultrasound Cardiac ultrasound is the visualization of cardiac anatomy by the use of computertransformed echoes of ultrasound. It is commonly used in the evaluation of mitral valve prolapse. There is an unclear association between mitral valve prolapse and panic attacks and anxiety disorders. REFERENCES Baron DA, Baron DA, Baron DH. Laboratory testing for substances of abuse. In: Frances RJ, Miller SI, Mack AH, eds. Clinical Textbook of Addictive Disorders. 3rd ed. New York: Guilford; 2011:63. Blumenthal JA, Sherwood A, Babyak MA, Watkins LL, Smith PJ, Hoffman BM, O'Hayer CV, Mabe S, Johnson J, Doraiswamy PM, Jiang W, Schocken DD, Hinderliter AL. Exercise and pharmacological treatment of depressive symptoms in patients with coronary heart disease: Results from the UPBEAT (Understanding the Prognostic Benefits of Exercise and Antidepressant Therapy) study. J Am Coll Cardiol. 2012;60(12):1053. Cernich AN, Chandler L, Scherdell T, Kurtz S. Assessment of co-occurring disorders in veterans diagnosed with traumatic brain injury. J Head Trauma Rehabil. 2012;27:253. Guze BH, James M. Medical assessment and laboratory testing in psychiatry. In: Sadock BJ, Sadock VA, Ruiz P, eds. Kaplan & Sadock's Comprehensive Textbook of Psychiatry. 9th ed. Philadelphia: Lippincott Williams & Wilkins; 2009:995. Kim HF, Schulz PE, Wilde EA, Yudosfky SC. Laboratory testing and imaging studies in psychiatry. In: Hales RE, Yudosfky SC, Gabbard GO, eds. Essentials of Psychiatry. 3rd ed. Arlington: American Psychiatric Publishing; 2011:15. Meszaros ZS, Perl A, Faraone SV. Psychiatric symptoms in systemic lupus erythematosus: A systematic review. J Clin Psychiatry. 2012;73(7):993. Mordal J, Holm B, Mørland J, Bramness JG. Recent substance intake among patients admitted to acute psychiatric wards: Physician's assessment and on-site urine testing compared with comprehensive laboratory analyses. J Clin Psychopharm. 2010;30(4):455. Perez VB, Swerdlow NR, Braff DL, Näätänen R, Light GA. Using biomarkers to inform diagnosis, guide treatments and track response to interventions in psychotic illnesses. Biomark Med . 2014;8:9–14. Roffman JL, Silverman BC, Stern TA. Diagnostic rating scales and laboratory testing. In: Stern TA, Fricchione GL, Cassem NH, Jellinek M, Rosenbaum JF, eds. Massachusetts General Hospital Handbook of General Hospital Psychiatry. 6th ed. Philadelphia: Saunders; 2010:61. Saczynski JS, Marcantonio ER, Quach L, Fong TG, Gross A, Inouye SK, Jones RN. Cognitive trajectories after postoperative delirium. N Engl J Med. 2012;367(1):30. Vannest J, Szaflarski JP, Eaton KP, Henkel DM, Morita D, Glauser TA, Byars AW, Patel K, Holland SK. Functional magnetic resonance imaging reveals changes in language localization in children with benign childhood epilepsy with

---

Revision #1
Created 2026-01-04 19:50:41 UTC by Omar Ayman
Updated 2026-01-04 19:50:41 UTC by Omar Ayman