

LABORATORY VALUES IN THE ELDERLY

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ABSTRACT. Laboratory values in the screening blood profile used by insurers are not significantly affected by aging alone. Most abnormalities are due to an underlying impairment, not old age. The cost-effectiveness of blood profile tests is greater in the older age market because the likelihood of disease is also greater.

Introduction

The number of blood profiles performed on elderly insurance applicants is increasing due to the development of new products for the older age market. This has generated concerns that the normal ranges for these tests may not apply to an elderly population.

What constitutes "normal" depends on one's frame of reference — It rarely means "ideal" or "perfect". It is determined from a reference population and includes factors such as age, sex, diet, exercise, etc.

Studies of blood chemistry results plotted as a function of age reveal considerable variation. Results from 21 to 40 year-olds are often different from those obtained from children and older people. However, most of the studies dealing with blood profile values in the elderly are generated from tests performed on hospitalized patients or those seeing their attending physicians. These presumably ill individuals are not representative of what would be expected among healthy, elderly insurance applicants.

Blood profiles in the elderly provide an important addition to the underwriting information obtained from the attending physician and other sources. This is because clinical diagnosis is more difficult in the elderly. Older patients often give a poorer history concerning their health and interpretation of physical signs is sometimes less clear. Multiple diseases may complicate the diagnostic process and atypical presentations of disease are especially common in old age. Elderly people with an undiagnosed impairment may simply experience a gradual decline in well-being whose features are no more striking than deterioration in energy, increasing frailty, and mild confusion or memory impairment.

Because the baseline probability of disease is high, blood profiles obtained from older age applicants are more likely to identify significant abnormalities than would tests performed on a younger population. This makes use of blood profiles

particularly cost-effective in the older age market.

Glucose

Community studies have shown that average fasting blood sugar levels rise with age by approximately 2 mg/dl per decade. Post-prandial (after eating) values rise 4 mg/dl per decade. These higher levels are thought to be due to decreased effectiveness of insulin in the peripheral tissues.

If the "normal" standards of a healthy control population are applied, a significant percentage of elderly individuals would be labelled diabetic. This has prompted the question, "is the elevation of blood glucose with advancing age physiologic — a normal accompaniment of healthy aging — or pathologic — accompanied by the diseases traditionally associated with diabetes mellitus?"

Several studies including the Framingham community study have noted that higher blood sugars at older ages are associated with a poorer prognosis. Researchers have concluded that a rise in blood sugar with age is primarily a pathological manifestation rather than a physiologic one. There is no convincing case for adjusting standards of normality for age. Higher fasting blood sugars are not benign age changes but appear to represent genuine impairment of carbohydrate tolerance. This is also true of post-prandial and random glucose specimens, although modest elevations may occur solely due to the decreased glucose tolerance that accompanies aging.

BUN, Creatinine

The levels of BUN (blood urea nitrogen) and creatinine are largely determined by renal function. Both are also influenced by other factors. Urea is the primary end product of protein breakdown. The rate of urea production can vary considerably, being increased when dietary protein intake is high or if protein breakdown is increased in disease. Steroids, nonsteroidal anti-inflammatory medications, and certain other drugs can also elevate the BUN.

In contrast, creatinine is unaffected by protein intake since it is produced by the breakdown of muscle proteins. Instead, it is related to muscle mass and body weight. This is particularly important in the elderly. For example, a tiny elderly woman may have significant renal impairment even with an apparently normal creatinine. Creatinine values need to be corrected for body weight before they can be safely interpreted at the older ages.

In younger people, creatinine is generally considered to be a more reliable guide to overall kidney function than BUN. This

is not the case in the elderly. Studies have demonstrated that BUN is slightly superior to creatinine as a predictor of renal impairment even when the latter is corrected for variations in body weight.

Renal function shows a steady decline with age. Even so, BUN and creatinine are usually normal among healthy older individuals. For risk assessment, screening values may extend to the upper limits of the normal range or perhaps be minimally elevated in an unimpaired elderly applicant. Greater elevations usually indicate underlying renal impairment.

Albumin, Globulin

The normal range of values for serum albumin in the healthy elderly is similar to that of a younger population because the liver is able to maintain normal production throughout life in the absence of illness. Nonetheless, screening blood profiles are more likely to identify low albumin levels in the elderly. This is usually due to the general effects of illness rather than a specific disease. Disorders associated with a low albumin include myocardial infarction, infections, inflammatory disease, burns, trauma, surgery, cirrhosis, other liver diseases, nephrotic syndrome, glomerulonephritis, ulcerative colitis and other gastrointestinal impairments, pressure sores, and leg ulcerations. Values tend to mirror the severity of illness: low values have considerable adverse prognostic significance.

Globulin levels are also normal in the healthy elderly. Within the broader group of all older aged people — impaired and unimpaired — there is a gradual increase in serum globulins with age due to impairments such as acute or chronic infections, tumors, rheumatoid arthritis, benign monoclonal gammopathy and multiple myeloma.

For underwriting purposes, a low albumin or elevated globulin in the elderly applicant may provide an indication of the severity of illness but seldom permits a specific diagnosis. Unexplained values warrant further investigation. Consultation with the medical director is usually necessary.

Alkaline phosphatase

There are conflicting opinions in the medical literature concerning the effects of aging on alkaline phosphatase. Some authors report mild elevations — up to 20% above the top of the normal range — with normal aging, primarily in women. Others conclude that alkaline phosphatase is no higher in the elderly if the diseases which might affect this test are carefully excluded.

Part of this uncertainty exists because the impairments that can elevate the alkaline phosphatase are so common in the elderly: osteomalacia, liver disease, fractures, malignancies with bone involvement, Paget's disease, inflammation of the bone (periostitis) due to chronic leg ulcerations, and rheumatoid arthritis. Worthy of special note is the lack of elevation due to degenerative joint disease (osteoarthritis).

For cases where the cause is definitely known, it is reasonable to "rate for cause" as long as there are no other laboratory abnormalities and the alkaline phosphatase is no more than twice the upper limit of normal. A liberal approach can also be justified for elevations of unknown cause where the alka-

line phosphatase is within 20% of the top of the normal range and there are no other suspicious factors. Other cases should be referred to the medical director.

GGTP

GGTP (Gamma Glutamyl Transpeptidase) increases between ages 6 and 60, then decreases thereafter. These fluctuations are more striking in males than in females. Nonetheless, values above the published normal range are usually due to some cause other than advancing age. Factors most often identified are medications, alcohol consumption, and obesity.

Bilirubin, AST, ALT

Bilirubin, AST (Aspartate Aminotransferase/SGOT), and ALT (Alanine Aminotransferase/SGPT) are not affected by aging.

Cholesterol, Triglycerides

Total cholesterol, LDL (low-density lipoprotein) cholesterol and triglyceride values increase with age from 20 to 65 years and then plateau or fall. HDL (high-density lipoprotein) cholesterol increases slowly and plateaus after age 65.

Uric acid

Uric acid is affected by renal function. The normal range of this test is somewhat higher in the elderly for this reason, and thus is not useful for routine screening of older age applicants.

Hemoglobin

This test is not routinely obtained as part of the risk assessment process. Rather, it may be encountered in an attending physician's statement as part of a complete blood count (CBC). Hemoglobin is not affected by aging.

Glycosuria, Proteinuria

Glycosuria (glucose in the urine) is far less useful as a screening test for diabetes in older individuals. In one study, almost half of the elderly patients with hyperglycemia did not exhibit glycosuria. This is due to elevation of the renal threshold for glucose at older ages. In other words, glucose will not appear in the urine of an elderly person until the blood glucose becomes significantly elevated. This has important implications in risk assessment. Glycosuria in an elderly applicant means that diabetes is likely. And the absence of glycosuria is no guarantee that diabetes is not present.

Proteinuria is no more common in the elderly than in younger individuals. It usually indicates some form of kidney disease. Glomerulonephritis, pyelonephritis, nephrosclerosis, and diabetic nephropathy are most often responsible.

General considerations

The factors that must be considered when interpreting abnormal blood profile results in the elderly applicant are applicable at all ages.

Technical factors — Did the test sample actually come from the applicant, i.e., was the specimen mislabeled by the paramedical or laboratory? Did an unusual delay occur before the test was performed that could have affected the results? Was

there an error in the test procedure itself? Dealing with reputable laboratories and paramedicals is of paramount concern.

Statistical variation — Normal ranges are determined from ostensibly healthy populations. The test is initially performed on a large number of people and the average (mean) value is calculated. High and low cut points are established on either side of the average value so that 95% of all values fall within this range. Thus, by definition, 5% of healthy subjects will have results somewhat outside the range. These would be false positives, i.e., these individuals would be unimpaired but their test results would be abnormal. How can these situations be identified during underwriting? One clue is the degree of abnormality. As the test result becomes more and more abnormal, it is less likely that the test is a false positive. Another clue relates to other abnormalities that are present. For example, if multiple liver enzyme tests are abnormal, statistical variation is probably not the cause.

Medications — The elderly take more medications than youn-

ger populations. These may interfere with test procedures, cause side effects within the body that are detected by screening tests, or precipitate other diseases. For instance, many medications elevate liver enzymes, hyperglycemia may be precipitated by thiazide diuretics or steroids, and aspirin and non-steroidal anti-inflammatory medications may elevate BUN and creatinine in the elderly due to unrecognized renal impairment.

Conclusions

A review of the medical literature confirms that most laboratory values in a screening blood profile are not significantly affected by aging alone. Abnormalities are usually due to an underlying impairment rather than older age. The cost-effectiveness of blood profile tests in the elderly is greater than in a younger population because of the higher likelihood of disease.

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