INTERPRETATION GUIDE FOR EXA TEST

THE INDIVIDUALIZED REPORT FORM IS INTENDED FOR PROFESSIONAL INFORMATIONAL PURPOSES (FROM CURRENT MEDICAL LITERATURE), TO ASSIST PRACTITIONERS IN CHOOSING APPROPRIATE TREATMENT AND IS NOT INTENDED TO RECOMMEND TREATMENT OR TO MAKE SPECIFIC DIAGNOSIS BASED ON SUCH DATA.

DECISIONS ON PATIENT CARE SHOULD BE BASED ON ALL LABORATORY TESTS, HEALTH HISTORIES AND CLINICAL EVALUATIONS.

MAGNESIUM-DESIRABLE INTRACELLULAR REFERENCE RANGE: 33.9-40mEq/l

Adequate intracellular magnesium is essential to normal tissue and organ function. Next to potassium it is the most abundant cation in cells and tissues. Measurement of intracellular levels with the EXA test is vital to maintain and treat many medical syndromes.

Serum levels, RBCs and lymphocytes do not adequately reflect cell or tissue levels of magnesium.

Magnesium modulates tissue transport of calcium and potassium ions and participates in hundreds of enzyme systems including formation of high-energy compounds such as ATP. All physiological activity, secretion, bone formation, cardiac and neuromuscular activity is affected by magnesium in tissues,

Optimal tissue levels of magnesium prevent cardiac irregularities and tend to maintain lower blood pressure. Magnesium concentrations in optimal ranges indicate possible lowered risk factor for hypertension, angina, arrhythmias and vascular spasm.
RDA for MAGNESIUM IS 350-400 mg

LOW MAGNESIUM

Determination of low tissue magnesium using the EXA test is vital to the objective treatment of depleted patients. Magnesium loss affects normal tissue and organ function while modulating transport of potassium, calcium, and phosphorus within tissues.

Causative factors of Mg deficiency include diabetes, use of diuretics and digitalis, excessive stress, exercise, malabsorption, poor diet, alcoholism, and heavy metal poisoning.

LOW magnesium has been associated with EKG and cardiac abnormalities, fibrillation, vascular and muscle spasms. Correlations with migraine headaches, asthma, eclampsia, PMS, and chronic fatigue syndrome are abundant in the medical literature. Low magnesium is seen in cardiac failure and prolonged QT syndrome. Neurological disorders, panic attacks and nerve irritability have been associated with low tissue magnesium levels.

HIGH MAGNESIUM

Since the kidneys excrete excess magnesium, it is rare to find tissue levels, which exceed optimal levels. Excess tissue magnesium has a sedative and hypotensive effect and supplementation must be used with caution in renal disease. B-complex vitamins, especially B-6 appear to enhance magnesium transport. Kidney function is the major excretory pathway for magnesium.

In kidney disease excess retention of magnesium can cause impairment of kidney and CNS function. High intravenous doses of magnesium have been used in eclampsia, asthmatic attacks and to convert intractable cardiac arrhythmias. Patients with cardiac failure and renal disease may retain magnesium in the tissues. ACE inhibitors also cause magnesium retention.

CALCIUM-DESIRABLE INTRACELLULAR REFERENCE RANGE: 3.2-5.0 mEq/l

Calcium is involved in secretory functions of tissues at the cellular level. Neurotransmission and neuromuscular transmission require regulated calcium movements. Structure of the supportive tissues, bone and cartilage, involves normal calcium metabolism.

Serum calcium is narrowly regulated by endocrine secretions. Intracellular calcium may vary much more than serum levels and tissue imbalances can cause a variety of syndromes affecting bone/tooth formation, blood clotting, heart rhythm, and permeability of cell membranes.

RDA for CALCIUM is 800-1,200 mg

LOW CALCIUM

Deficiency of cellular calcium may be expressed with symptoms of peripheral numbness, brittle fingernails, fragile bones, cardiac palpitations, hypertension, insomnia, CNS irritability leg and muscle cramps, osteomalacia, osteoporosis, and periodontal disease.

There is evidence that low tissue calcium contributes to PMS, and muscle flaccidity. Cardiomyopathic heart tissue appears to have diminished concentrations of calcium.

True decrease in the physiologically active Ca^{++} occurs in many situations, including hypoparathyroidism, vitamin D deficiency, chronic renal failure, magnesium deficiency, prolonged anticonvulsant therapy, acute pancreatitis, massive transfusion, and alcoholism.

HIGH CALCIUM

Elevated tissue calcium may be a sign of mobilization of bone calcium into soft tissues signaling early signs of developing osteoporosis. High intracellular calcium interferes with ATP formation, muscle contraction, relaxation, enzyme activity, and neuromuscular transmission.

Increased cellular calcium predisposes to spasm of peripheral arterioles leading to increased blood pressure. Calcium may also be a factor in plaque formation, angina, hypertension and athero-arteriosclerosis. Calcium channel blockers as well as magnesium affects movement of calcium into the soft tissues and heart muscle.

Parathyroid hormone, which regulates calcium, is increased when magnesium is low. PTH is lowered when magnesium stores are high. Hypomagnesia occurs commonly in hyperthyroidism.

Hypercalcemia is seen in malignant neoplasms (with or without bone involvement), primary and tertiary hyperparathyroidism, sarcoidosis, vitamin D intoxication, Paget's disease of bone, thyrotoxicosis, acromegaly, and the diuretic phase of renal acute tubular necrosis.

In summary: Elevated intracellular calcium might indicate loss of calcium from skeletal tissues and might possibly indicate that the adequate intake of daily calcium be maintained or increased, depending on the judgment and diagnosis of the physician.

RDA for CALCIUM is 800-1200 mg

POTASSIUM-DESIRABLE INTRACELLULAR REFERENCE RANGE: 80.0-240.0 mEq/l

Potassium is essential for normal nerve and muscle function and has a profound effect on maintaining normal cardiac function. The extent of potassium loss in tissue cannot be accurately assessed by serum measurements alone.

Adequate measurements of TISSUE and serum potassium are essential in determining cellular fluid balance. Maintenance of cardiac skeletal and smooth muscle and nerve function depends on adequate potassium gradients between intra and extracellular spaces. All neuromuscular activity is dependent on both sodium and potassium for maintaining the electro-potential in both nerves and muscle.

The major means of regulation of potassium is though the kidneys, as well as the gastrointestinal tract and skin. Serum potassium may not reflect the tissue levels when potassium is given. EXA testing provides information before a crisis of potassium loss or excess is identified in serum. Lack of magnesium is a major factor in loss of potassium. RDA for POTASSIUM is 1875-5625 mg.

HIGH POTASSIUM

Tissue potassium may be elevated despite normal serum levels. The EXA test reveals the tissue levels in the face of either excess or low potassium in the serum. Excess potassium can cause profound changes in membrane potentials and altered EKG readings.

Elevated tissue potassium may be due to intravenous administration, hormonal therapy (excess insulin), acidosis, or dietary intake. Cellular electrolyte levels and resting membrane potentials are affected by tissue potassium, sodium and calcium concentrations. Potassium in tissues is about 30-40 times greater than serum

LOW POTASSIUM

Low magnesium leads to low tissue potassium since magnesium is absolutely needed for potassium transport into tissue. Risk for cardiac irritability, irregularity and hypertension have related to loss of cellular potassium Depletion occurs when potassium output exceeds intake.

Loss may be seen in adrenal insufficiency, excess sweating, diuretic use, steroid use, alcoholism, dietary loss, diarrhea, vomiting, renal disease, alkalosis, and malabsorption. High protein weight loss programs or diabetic keto acidosis can cause lose of K as well as Mg due to excretion of ketones during the sudden mobilization of fats.

SODIUM-DESIRABLE INTRACELLULAR REFERENCE RANGE: 3.8-5.5 mEq/l

Sodium balance is a reflection of Na intake and output. ATP driven sodium and potassium pumps are vital in maintaining the gradients of potassium and sodium inside and outside the cell. These pumps are highly dependent on magnesium to energize the enzymes of the active transport process.

Cellular charge, function and integrity are a combination of sodium and potassium pumps, which maintain electrolyte and mineral balance in cellular events.
RDA for SODIUM is 1100-3300 mg

HIGH SODIUM

Diets high in sodium might increase of sodium in the body causing swelling or edema. Water retention elevates the blood pressure, puts a strain of the heart and kidneys and results in congestive heart failure. In liver disease, venous obstruction causes fluid to leak
into the abdominal space (ascites) which lowers the effective blood volume which in turn causes salt and water retention as seen in heart failure.

Hypertension can result from sodium and water retention. Renal disease will also result in salt and fluid retention Excess sodium can upset the delicate potassium/sodium balance which influences all neuromuscular activity including cardiac function.

LOW SODIUM

Sodium is the principal cation of the serum. Changes in Na levels tend to affect other ionic compartments. Sodium loss may be due to vomiting, diarrhea lack of intake, excessive sweating fever, hot environment, exercise, as well as adrenal insufficiency, hypoaldosterism, diuretic use and renal disease. Burn patients may also lose sodium.

Lack of sodium chloride might cause muscle cramps, dizziness, and possible convulsions. Some individuals respond to low sodium intake with hypotension. Renal sodium excretion can be affected by cardiac output, multiple endocrine factors, and diuretics. Diuretic treated patients may be subjects for both potassium and magnesium support.

CHLORIDE –DESIRABLE INTRACELLULAR REFEERENCE RANGE: 3.4-6.0 mEq/l

The amount of chloride ions in the body is a reflection between intake and output and parallels that of sodium ingestion. Chloride is present in higher concentrations in the serum than inside the cells. Chloride ions tend to diffuse into the cells to a negatively charged cytoplasm and are pushed out along an electrical gradient until balance is achieved. If sodium and potassium - ATP driven pumps are not working, (possible Mg depletion), chloride tends to enter the cell causing them to swell. Cell integrity is a result of ion movements to maintain homeostasis along with sodium and potassium.
RDA of CHLORIDE is 1100-3300 mg.

HIGH CHLORIDE

Excessive cellular chloride has been reported to contribute to hypertension. The negative chloride ions tend to diffuse into tissues along with potassium and sodium. Potassium internal cell concentration is 30 times greater than outside the cells. Thus, high chloride results when positive sodium and potassium ions move into the tissues. High levels may be caused by sodium retention or high salt intake as well as kidney malfunction, or side effects of corticosteroids.

Changes in cellular chloride are seen in dehydration, renal tubular acidosis, acute renal failure, diabetes insipidus, prolonged diarrhea, salicylate toxicity, respiratory alkalosis, hypothalamic lesions, and adrenocortical hyperfunction.

LOW CHLORIDE

Dehydration caused by infectious diseases and diarrhea or severe vomiting with fever, can cause deficits in body chlorides. Excessive sweating, exercise, hot environment, and conditions similar to sodium depletion are factors. Renal disease and adrenal insufficiency (hypoaldosteronism) may cause low body chloride.

Restriction of salt intake tends to lower chloride intake as does extensive renal loss and some diuretics. Low sodium diets can lower the chloride levels. Osmotic diuresis as seen in diabetes mellitus may deplete chloride. When cellular potassium is low, chloride levels are also lower, since chloride is transported with sodium and potassium.
RDA of CHLORIDE is 1100-3300 mg.

PHOSPHOROUS-DESIRABLE INTRACELLULAR REFERENCE RANGE: 14.2-17.0 mEq/l

Phosphorus is needed for the formation of cell membranes, DNA and RNA structure, and the formation of high-energy compounds such as ATP. Phosphorous is among the most abundant constituents of all tissues. The Calcium-Phosphorous balance is essential for bone formation, soft tissue structure and energy transduction within all muscles and nerves.
RDA for PHOSPHOROUS is 800-1200 mg.

HIGH PHOSPHOROUS

Excessive cellular phosphorus may block magnesium entry and combine with calcium within cells. During a myocardial infarction phosphorous and calcium may crystallize into destructive intracellular materials, which damage heart muscle. High cellular calcium and phosphorus compounds prevent exit of calcium in tissues. When more phosphorus than calcium is ingested, PTH tends to favor bone demineralization and accumulation of Ca in soft tissues thus affecting multiple normal enzyme actions. Diets of soft drinks, red meat and wine, cheeses, and dairy products have high phosphorus along with some water supplies

Hyperphosphatemia may occur in myeloma, Paget's disease of bone, osseous metastases, Addison's disease, leukemia, sarcoidosis, vitamin D excess, healing fractures, renal failure, hyperparathyroidism, diabetic ketoacidosis, and acromegaly.

LOW PHOSPHOROUS

Low levels of cellular phosphorous my be caused by low dietary intake, malabsorption, and hypoparathyroidism, The malnutrition effects seen in alcoholics may occur following 2-4 day of hospitalization due to decreased levels of ATP in red cells, causing less oxygen to the vital tissues. Diarrhea, vomiting magnesium deficiency or use of aluminum-containing antacids may deplete phosphorous. . Anorexia, dizziness, bone pain, muscle weakness and waddling gait along with rises in serum creatinine kinase might indicate muscle injury along with myopathy.

Hypophosphatemia can also be seen in a variety of biochemical derangements, including, sepsis, hypokalemia, malabsorption syndromes, and hyperinsulinism.

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INTRACELLULAR ELECTROLYTE RATIOS

Ratios indicate physiological relationships between vital cellular elements. If all individual elements are within the reference ranges it is possible to have a ratio out of the range.

If elements being ratioed read in the high or low end of the range, their altered physiologiclal balance may be of importance in cell homeostasis.

The significance of the ratio is to maintain opitmal balance between all electrolytes for determining risk factors associated with either an excess or deficiency of intracellular ions. If the indiviual elements are within reference ranges, a borderline Magnesium and high Potassium could produce a pardoxical ratio. Therefore, Individual element concentrations should be evaluated for their effects on ratios.

MAGNESIUM/CALCIUM.....As this ratio lowers, cardiac risk factors increase and ATP production decreases. Serious pathology such as calcinosis, atherosclerosis, vascular occlusion, acute myocardial vasospasm or infarction with related arrhythmias are believed to be related to such imbalances.

PHOSPHORUS/CALCIUM.....If both phosphorus and calcium are high, , the relationship in the ratio may be in the desirable range. However, Tendon, ligament and bone structures are related to ratios of phosphorus and calcium. Increased indvidual levels of calcium or phosphate in soft tissues can adversely affect enzyme systems, reducing transport and synthesis of high energy compounds.

MAGNESIUM/PHOSPHORUS.....Depression of Mg/P in tissue tends to block entry of magnesium into cells which may result in lowered intracellular enzyme activity. Excessive dietary phosphorus can cause physiological cellular changes particularly when the Mg/Ca ratio is also low.

POTASSIUM/CALCIUM.....Both calcium and potassium might be elevated but the ratios could be in in range. Potassium lowers the tendency towards increased peripheral arterial resistance, and spasm in renal and coronary circulation. High cellular calcium has been shown to increase intracellular potassium concentration.

POTASSIUM/MAGNESIUM.....Magnesium has a potassium sparing effect and is the rate limiting ion for potassium transport. In most cases, when magnesium is low..potassium is low. If magnesium is borderline (low), and intracellular potassium is out of range (high), . a high paradoxical ratio may result. It would be best to look at the individual element concentrations.

POTASSIUM/SODIUM.....Active transport of K and Na produces major energy processes, normal cell volume, and is vital to ion transport, as well as producing the membrane potentials for all secretory functions, neurotransmission, and neuromuscular activity. Serum potassium levels are not good indicators of tissue levels. This ratio is vital to establishment of homeostasis for normal function of intracellular biochemical events.