Mini Review

Pre collection variables anthral laboratory testing

Introduction

Traditionally, laboratory practice is divided into 3 phases pre-analytical, analytical, and post-analytical. All these phases of total testing process are to be targeted for improving quality and to provide accurate diagnosis. Bonini and colleagues studied that pre-analytical errors predominated in the laboratory, ranging from 31.6% to 75%.[1]

Pre-analytical variables refers to all those procedures that occur during sample collection and prior to sample collection that is pre collection variables thus pre analytical process includes patient identification, physical sample collection, sample transportation to the testing site and sample preparation. The errors during this phase can have a significant impact on laboratory results and it is imperative that laboratory personnel are able to spot these erroneous results, rather than falsely attributing them to an underlying medical cause. To improve quality, accurate results are must and this begins with obtaining quality sample first.

Our article describes the common types of pre collection variables in testing process which include diurnal variation, exercise, fasting, diet, tobacco smoking, alcohol consumption and posture.

Diurnal variation

For some parameters the time is very important as they show diurnal variation so laboratory personnel must be aware of it for giving right values and right diagnosis .For some analytes as cortisol morning and evening levels are different so the laboratory may provide different time related normal ranges. For serum iron levels, as 30% lower in the evening as compared to morning, so the serial collections at similar times of the day will minimize differences related to diurnal variation. Thus all laboratory personnel must be aware of these parameters for giving right values and correct diagnosis which impacts the patient's life.

Common analytes exhibit Diurnal variation are as follows

ACTH	Lower at night
Aldosterone	Lower at night
Insulin	Lower at night
Growth hormones	Higher in afternoon and evening
Acid phosphatase	Higher in afternoon and evening
Plasma renin activity	Lower at night
Prolactin	Higher levels at 4 and 8a.m and 8 and 10p.m
Iron	Peaks early ,decrease upto 30% during the day
Cortisol	Peaks at 4-6a.m, lowest 8p.m to 12 a.m,50% lower at 8p.m than at 8a.m

Diet

An individuals diet can greatly affects laboratory test results. Glucose and triglycerides, absorb from food increases after eating.[2] Longtime vegetarian diets are reported to cause decreased concentrations of low density lipoproteins, cholesterols, phospholipids and triglycerides. Vitamin B12 deficiency can also occur unless supplements are taken.[3] Just as the ingestion of food can cause substantial changes in the blood level of some analytes, prolonged period of food deprivation

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or fasting can also cause remarkable change. Thus the knowledge of these variables is must for every personnel in the laboratory.

The following variables are affected by prolonged Fasting.[4]

Increase	Decrease
Amino acid	Glucose
Bilirubin	High density lipoprotein cholesterol
Fatty acid	Insulin
Glucagon	Lactate dehydrogenase
Ketones	Tri idothyronine
Lactate	
Triglycerides	

Exercise

Physical activity has transient and long term effects on various laboratory parameters .Transient changes may include an initial decrease followed by an increase in free fatty acid. Alanine may increase as much as 180% and lactate as much as 300%.

During collection if there is pumping of the fist is attempted this will cause local changes that will give erroneous result. Exercised muscle deprived of oxygen results in increased lactic acid and decreased PH, thus the acquaintance of all these are must for preventing pre analytical errors. As majority of Physicians diagnosis are based on timely and accurate results of laboratory the pillars of which is quality sample first.

The following analytes are impacted by Exercise

Aspartate aminotransferase
Bilirubin
Creatine kinase
Hormones
Lactate dehydrogenase
Neutrophils
Uric acid

Posture

Posture of a patient during phlebotomy can have effect on various laboratory test results. An upright position increases hydrostatic pressure ,causing a reduction of plasma volume and increase concentration of proteins. Most hospitalized patients are supine when

blood specimens are obtained, however most normal value studies are performed on specimen from persons being in upright position. Thus these studied populations may have different results.

The laboratory standardization panel on blood cholesterol measurement of national institutes of health recommends blood draw after 5 minutes of rest to collect sample for cholesterol and lipoprotein measurement so as to reduce postural change.[5]

Laboratory variables affected by changing position from lying to standing [Posture].

Pressure and Volume Sensitive Hormonal Changes	Protein Bound Non diffusible Analytes
Aldosterone	Albumin
Angiotensin	Bilirubin
Antidiuretic hormone	Calcium
Catecholamines	Cholesterol
Renin	Enzymes
	Total proteins
	Triglycerides

Tobacco smoking

Tobacco smokers have high blood carboxy hemoglobin level, plasma catecholamines and serum cortisol. Chronic smoking lead to increase in hemoglobin level, red blood cell counts, Mean corpuscular volume and leucocyte count thus to take clinical history at the time of collection of sample is must to avoid any erroneous results .

Conclusion

Erudition of various preanalytical variables that can adversely affect laboratory results is must to prevent preanalytical errors.

Although monitoring efforts may detect errors but prevention is the key to reduce pre analytical errors. Ideally the system should include checks and controls at all the levels of processing test. Prevention also requires continuous education and cooperation of physicians, nurses, clerks, phlebotomists and other laboratory personnels to ensure that right results are delivered through laboratory as behind every test tube there is a patient who need correct diagnosis to live healthy.

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Conflicts of interest

Author declares that there is no conflicts of interest.

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