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DIAGNOSTIC YIELD OF ROUTINE BIOCHEMICAL INVESTIGATIONS AMONGST PATIENTS IN A RURAL TEACHING HOSPITAL

Biochemistry

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ABSTRACT

Laboratory investigations are an important and reliable tool for proper diagnosis and treatment, carried out to confirm the findings or to estimate the etiology. Effective use of clinicians and the clinical laboratory has great implications on the cost and operational efficiency of the hospital. This study aimed to determine the diagnostic yield of certain routine clinical biochemical investigations in a rural teaching Hospital which was conducted in the central lab of the Department of the Biochemistry, Adesh Medical College and Hospital, Mohri, shahbad (M), Haryana. Out of 15 types of clinical biochemical investigations ordered, 11 types of tests were found to be in between 17% to 29 % diagnostic yield (low yield). Only four types of investigations were found to be in intermediate diagnostic yield percent in which Na+ has highest (41.2%) yield percent. The overall/average yield percent was found to be 27.7%. So, the laboratory investigations do assist a clinician in proper diagnosis, treatment and prevention of any illness or complications arising out of it. But unnecessary investigations must be ruled out in order to reduce the expenditure, man power and machinery damage due to overload.

KEYWORDS

Biochemical, laboratory, rural, yield, investigations.

Introduction

Clinical biochemistry refers to the analysis of the blood plasma (or serum) for a wide variety of substances-substrates, enzymes, hormones, etc and their use in diagnosis and monitoring of disease. Analysis of other body fluids (eg, urine, ascitic fluids, CSF) is also included.

American Society of Anesthesiologists (ASA) Task Force on Preanesthesia Evaluation (2002) defined routine tests as those done in the absence of any specific clinical indication or purpose (i. e. tests intended to discover a disease or disorder in an asymptomatic patient and traditionally include a panel of blood, urine tests and X-ray chest, electrocardiogram) (1). However, the usefulness and cost-effectiveness of routine screening tests in the absence of any clinical indication has been questioned as the probability of finding a significant abnormality is small for laboratory tests, electrocardiogram, and chest radiography (2-9).

During 1940-1960, clinicians elicited thorough history and physical examination for preoperative assessment and only selective laboratory tests were ordered to confirm or refute clinical diagnosis (13, 14). In late 1960s, the introduction of a biochemical auto-analyzer made it easier for clinicians to obtain a large number of tests with a small addition of cost. The ease of ordering and low cost of obtaining many laboratory tests made this new method of evaluation attractive (15). This practice evolved from the assumption that early and frequent testing could detect disease in their pre-clinical stage to allow early and less costly treatment (13, 16). This thinking was accepted as dogma and rapidly made its way into medical mindset of all health care workers such that excessive testing was equated with efficient care (16). Many hospitals made rather arbitrary rules to perform a series of laboratory tests prior to any operative procedure (15, 17) with the assumption that voluminous information would enhance the safety of surgical patients and reduce the liability for adverse events (16). But, several observers have noted significant over utilization and in appropriate utilization of laboratory services by patient care physicians, even at teaching Hospital (18). Virtually, junior medical staff in teaching Hospital orders maximum diagnostic tests, and are often directly responsible for the tests ordering patterns. Their test-ordering behavior is largely determined by 'protocol' or 'routines' that the junior medical staffs have developed without consideration of efficient use of the laboratory tests. These protocols then are passed on to successive batches of residents and serve as a major source of education for the house staff in laboratory testing (19, 20). Laboratory tests accounts for an estimated 10% of total cost of health care. The volume of tests performed by clinical laboratories has been rising by 10 % to 20 % or more each year for the past 20 years (20).

Laboratory investigations are recommended for the following purposes:-

1) Diagnosis: The test has to be positive in a population with the disease and negative in those who are not affected by it.
2) Monitoring: The test is carried out in order to assess the therapeutic effect of the drug/s administered.
3) Screening: The test is done to detect a disease in its presymptomatic stage to avoid the ill-effects arising out of it. (21)

The aim of this study was to determine the yield of simple clinical chemistry investigations across different test-ordering categories, in a rural teaching Hospital. The idea was to study the pattern of test ordering by the treating physicians and residents. We performed a prospective study to determine why a particular test was ordered and the proportion of test results which yielded an abnormal value.
Most commonly, blood sample is analyzed to detect the biochemical profile of patients. The serum, separated from the blood, is the most important constituent for various enzymes, electrolytes and other parameters.

Materials and Methods:

The Central Clinical Laboratory (CCL) of Adesh Medical College and Hospital, Mohri, Shahbad (M), Kurukshetra, carries out approximately 1.68 lakh Biochemical investigations in a year. This study was conducted in this laboratory and the department of Biochemistry amongst patients attending wards and admitted in the hospital during a period of six months in the beginning of the year 2018.

Source of Data:

In-patients of the various departments of the Hospital constituted the major source of data for the present study. A 'Daily Investigations Record Register' was maintained in the Department to record the results.

Data Abstraction:

The most common investigations being performed by the lab were identified and enlisted. The possible reason for ordering the test were also identified from the information available from the case-sheet and the treating physicians comments (Table 1).

Table 1: Biochemical Investigations, their reference ranges and type of investigation along with common indications.

Investigation	Reference Range	Type Of Investigation And Common Indications
Blood Sugar (Fasting)	60-100 mg/dl	Screening, Diagnosis and Monitoring
Blood Sugar (Random)	Upto 200 mg/dL	(Diabetes Mellitus, Stroke, Hypertension, Preoperative assessment)
Blood Sugar (Post – Prandial)	Upto 140 mg/dL	(Hypoglycaemia, malnutrition)
Blood Urea	15 – 40 mg /dL	Screening, Diagnosis and Monitoring(Renal failure, Sepsis, Uraemia, Shock)

Serum Creatinine	0.6 – 1.4 mg /dL	Screening, Diagnosis and Monitoring (Sepsis, Metabolic cause, Renal failure, Poisoning, Hematemesis)
Serum Uric Acid	2.5 – 7.2 mg/dl	Screening, Diagnosis and Monitoring (Cardiac Patients, Gouts, Arthritis)
Serum Sodium	135 – 145 mEq/L	Screening, Diagnosis and Monitoring (Acid base balance, Drug Monitoring, Dehydration, Oedema, Diuresis, Mental,Generalized weakness, Altered behavior, Renal insufficiency)
Serum Potassium	3.5 – 5 mEq/L	Screening, Diagnosis and Monitoring (Acid base balance, Drug Monitoring, Dehydration, Diabetic Ketoacidosis, Mental, Generalized weakness)
Serum Chloride	96 – 106 mEq/L	Screening and Diagnosis (Drug monitoring, Fluid imbalance, Oedema)
Serum Total Proteins	6 – 7.8 gm/dl	Screening, Diagnosis and Monitoring (Malnutrition, Renal failure, Multiple myeloma, Hepetitis/Cirrhosis of Liver)
Serum Albumin	3.5 – 5 gm/dl	Screening, Diagnosis and Monitoring (Renal cause, Intoxication, Burn, Hepetitis/Cirrhosis of Liver, Assessment of Anasarca)
Serum Globulin	2.3 – 3.5 gm/dl	Screening, Diagnosis and Monitoring (Malnutrition, Renal failure, Multiple myeloma, Hepetitis/Cirrhosis of Liver)
Serum Total Bilirubin	Upto 1 mg/dL	Screening, Diagnosis and Monitoring (Hepatic disorders, Jaundice, Gall bladder diseases)
Serum Direct Bilirubin	Upto 0.2 mg/dL	Screening, Diagnosis and Monitoring (Hepatic disorders, Jaundice, Gall bladder diseases)
Serum SGOT/AST	Upto 40IU/L	Screening, Diagnosis and Monitoring (CardiacDisorders, jaundice, Hepatitis, Drug Therapy Monitoring)
Serum SGPT/ALT	Upto 40IU/L	Screening, Diagnosis and Monitoring (Jaundice, Hepatitis Dysfunction, Drug Therapy Monitoring, Alcoholic Liver Disease)
Serum Alkaline PO4	Upto 115IU/L	Screening, Diagnosis and Monitoring (Hepatitis Dysfunction, Liver Disease, Bone Disorders)

Result and Discussion:

The most widely recognized ailments for which a laboratory investigation was requested and did were hypertension, upper respiratory tract contamination, carcinomas, cracks, gastritis, injury, viral fever, bronchitis, urinary tract infection, calculi, dengue, lipoma, iron deficiency, spondylitis, CHF, hernias, COPD, Koch's Disease, diabetic foot, and so on. The usually tested biochemical parameters and reason to distinguish their values were obtained and their values were recorded in a tabular arrangement for simple analysis (Table 1).

A descriptive statistical analysis of the collected data was done and the abnormal findings were then found and the diagnostic yield of each parameter was calculated according to the given formula (Table 2).

Diagnostic Yield = Number of abnormal findings / Total number of individuals x 100

Table 2: Yield of individual investigations.

Sr No	Investigation	Total No of Investigation	Abnormal Results	Diagnostic Yield (%)
1.	Blood Sugar	4165	1017	24.4
2.	Total Serum Protein	3015	705	23.4
3.	Serum Albumin	3014	855	28.4
4.	Serum Globulin	2980	700	23.5
5.	Serum Bilirubin (Total)	3226	744	23.1
6.	Serum Bilirubin (Direct)	3198	557	17.4
7.	SGOT/AST	3270	942	28.8
8.	SGPT/ALT	3248	869	26.8
9.	Serum ALP	3004	1036	34.5
10.	Blood Urea	5156	1845	35.8
11.	Serum Creatinine	5792	2173	37.5
12.	Serum Uric acid	5178	929	17.9
13.	Serum Na+	4272	1112	26.0
14.	Serum K+	4411	1034	23.4
15.	Serum Cl-	3140	1293	41.2
	Total	57109	15819	27.7

Based on the yield of the test (Table 2), investigations were classified as low yield (0 to 33%), intermediate yield (34 to 64%), and high yield (67% and above).[20]

The study was conducted for a six month period between January and June 2018, and a total of 57109 tests were evaluated. Serum Creatinine, urea, uric acid and blood sugar were the four most common test ordered in 5792 (10.14%), 5156 (9.02%), 5178 (9.06%) and 4165 (7.29%) cases respectively.

Of the 15 types of clinical chemistry investigations ordered 11 had low diagnostic yield ranging from 17 to 29 %. Serum bilirubin (Direct) and serum uric acid investigations had the lowest yield of them. Other important tests in this low yield group were serum K^+, total protein, globulin, bilirubin (Direct) and blood sugar which had a yield of 23 to 25 %. Coinciding with their low yield the reason for ordering these five types of investigations was unclear in as many as 4398 of the 17841 (24.6%) tests ordered. Other important tests in the low yield group were serum Na^+, SGPT/ALT, albumin SGOT/AST having diagnostic yield of 26.0%, 26.8%, 28.4% and 28.8%, respectively.

The investigations of serum ALP, urea, Creatinine and Cl^- had intermediate yield (ranges 34 to 42 %). Then average diagnostic yield of all popular tests taken together came found to be 27.7 % (Table 3).

Table 3: Overall yield of investigations by test ordering category

Number of tests ordered (% of total)	Number of abnormal tests	Percent Yield
57109	15819	27.7%

In this study we found that the diagnostic yield of different investigations varied from 17 to 42%, with most investigations having a low yield. This was directly related to the test ordering category.

Doctors order lab tests fundamentally to screen for unsuspected infection, to establish or to exclude an analysis, to demonstrate prognosis, to choose the most appropriate treatment and to screen treatment (22, 23). Frequently the tests are requested to affirm past outcomes and for medicolegal purposes. However, the cognitive procedure involved with the requesting of the clinical chemistry tests is complicated. Lab tests are critical elements of therapeutic practice, the cost effective use of clinicians and the clinical laboratory (24). The factors which contribute to the excessive use of laboratory tests are:

1) Differential test requesting conduct may exist in different physicians and their residents. Whenever tests were requested for unspecified reasons or for "just in case", they had most reduced yield. Most renal function tests were requested with no specific reason being apparent. This finding proposes that some test requesting algorithms or protocols might be required for these tests.
2) Most clinical chemistry tests are requested unsupervised by medical residents, and senior consultants. It is possible that a lot of test requesting conduct is passed starting with one generation of

residents then onto the next, and it turns out to be all the more a mechanical procedure rather an thoughtful one. Certain tests had a high diagnostic yield, (for example, liver function test) and this recommends some clinical screening was operative in the test requesting behavior. Possibly doctors frequently depend considerably on clinical features of hepatic function, (for example, presence of icterus), and a test requesting algorithm is operative at a subconscious level for these examinations. Connelly and Steele et al, told that physicians have essential role to keep away from the overuse of lab tests and recommended that medical instruction could be the key determinant in effective laboratory use (25).

3) Access of clinical chemistry examinations has suggestions for the patients, doctors and furthermore the laboratory. A large portion of the examinations establish an out-of-pocket cost for the patients, and will in general increment the general expense of medicinal treatment. Sometimes patients may request test execution paying little mind to cost because of broad insurance coverage and the requirement for reassurance (20).
4) Sometimes, physicians believe that patients are impressed by the performance of numerous tests of order of tests ordering to allay patient concerns or to completely work as a patient to satisfy or impress peers or supervisors.

Overuse of tests may be a defensive practice behavior on the part of the physician, but a higher number of asymptomatic abnormal test results make the patient management more confusing as well as challenging. Screening profile test can produce unexplained, abnormal results that generate additional work even though the data may represent only extreme values in healthy individuals. Additional tests request can be justified if results enhance diagnostic accuracy or improve patient management. Over utilization or mis-utilization of laboratory data occurs when irrelevant or repeat laboratory testing is ordered or when tests results are ignored. Laboratories often get overburdened with clinical chemistry tests and this could have a bearing on overall quality of functioning (20).

Conclusion and future perspective:

Laboratory examinations have consequently been turned out to be an indistinguishable piece of prescription. The prompt utilization of these can lead to easy diagnosis and productive treatment of any disease. The clinicians must enhance their knowledge and practical skills to request just for the significant tests and concentrate its actual essence. In addition, this would lead to a diminished loss of valuable resources. In this manner, a sense of appropriate lab tests should be inculcated in all the medical personnel.

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