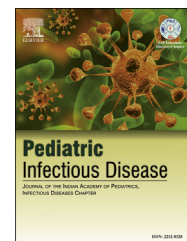


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Notes from the Lab

Common laboratory errors

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ABSTRACT

In this modern era of technology, there is plethora of investigations available in the market, but without deriving clinical diagnosis, indiscriminate use of laboratory investigations is expensive & misleading. Laboratory investigations are neither shortcut nor final answer to the diagnosis. Laboratory investigations should be planned after clinical diagnosis, derived from history & clinical examination. The clinician should also know the sensitivity, specificity & reliability of the test. All these merits of the test depend upon the accuracy of the test. The accuracy of any laboratory investigation depends upon several factors like collection of sample at appropriate time, collection of specimen in specific container, storage & transportation of sample, technique used for testing etc. The clinician should keep the possible laboratory errors in mind while interpreting the laboratory investigations.

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1. Introduction

Clinical diagnosis, derived from detail history & thorough clinical examination, is the pre-requisite for any laboratory investigation. Without deriving rational working clinical diagnosis, indiscriminate use of laboratory investigations is expensive & misleading. Investigations are neither shortcut nor final answer to the diagnosis. Of course, the advancement in technology & availability of modern facility for investigations has brought the revolution in clinical medicine. Still, it should be considered as an extra help in deriving the diagnosis. It is not the final answer. It is not the substitute for the clinical diagnosis. One should also know the technicality

of the kits used for the laboratory investigations. Sensitivity, specificity & reliability of the test should be known to the clinician as interpretation of the test is based on that ground. The accuracy of any laboratory investigation depends upon several factors like collection of sample at appropriate time, proper technique of collection of sample, collection of sample in specific container, storage & transportation of sample, treatment received by the patient before collection of specimen, technique used for testing etc. The clinician should keep the possible laboratory errors due to all these factors in mind while interpreting the investigations. The present manuscript contains some of the common laboratory errors & the precautions to avoid them.

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2. Precautions to be taken to avoid laboratory errors

- Collection of sample at appropriate time

It is very common practice to treat the patient without clinical diagnosis & laboratory support with anti-malarials & antibiotics. With no response to irrational medicines, performing laboratory investigations & to interpret them for diagnosis is another mistake. The collection of specimen for investigations after antimicrobial therapy may not be helpful, may be confusing or misleading.¹ Preparation of thick & thin peripheral blood smears for diagnosis of malaria before starting the anti-malarials is very crucial. Timing of sample collection should be as soon as malaria is suspected. It can be collected any time irrespective of fever & not necessarily only at the height of fever.^{2,3} Smear should be prepared soon after collection which enables better adherence films to the slide & causes minimal distortion of parasites & red cells. In blood collected with anticoagulants films should be prepared within 2 h for best results.^{2,3} The specimen should be collected at a stage of illness when organisms may be found in maximum numbers. E.g. *Salmonella typhi* is most likely isolated from blood during the first week of illness. Blood sample for Serum Widal should be collected after 7 days of fever in a suspected case of enteric fever.^{4,5} Dengue NSI antigen detection test can be detected in serum from day 1 after onset of fever & up to day 9. But the serological tests for dengue fever should be performed after 5 days of illness.⁶ Performing lumbar puncture & sending cerebrospinal fluid for examination before starting antibiotics in a suspected case of acute bacterial meningitis is another example for best timing of collection of specimen.

- Proper technique of collection of sample for testing

The improper technique while collection of blood can cause hemolysis & may interfere with the tests or may produce erroneous results. The estimation of K^+ from hemolysed blood sample may show erroneous hyperkalemia. The factors contributing to hemolysis include injury to erythrocytes caused by needle, withdrawing blood before alcohol applied to the skin dries up, centrifugation & even rough handling of the specimen during transportation.⁷

The collection of blood & urine for culture should be under strict aseptic condition as per standard technique.^{1,8–10} The body fluids from sterile areas like CSF, ascitic fluid, pleural fluid etc. should not be contaminated while collection, otherwise the result will be misleading. One should take care to minimize contamination with normal flora, while collecting the throat swab & nasal swab.¹

Mantoux test should be performed on volar aspect of forearm by intradermal route. If the technique of testing is not appropriate & given by subcutaneous route (which is common in the practice), its interpretation will be wrong.¹¹

- Proper container for collection of specimens

The specimen should be collected in appropriate container for specific test, otherwise the result may be erroneous. The

suggested containers for collection of blood samples for specific tests are defined (Table 1).⁷

- Proper storage of samples

All specimens for culture from normally sterile areas like blood, CSF, ascitic fluid, pleural fluid etc. should be kept at room temperature. Do not refrigerate these samples since some of the potential pathogens are temperature sensitive.^{1,8–10}

Urine must be cultured within 1 h of collection. If it is not possible, urine sample should be preserved at 2 to 8 °C in refrigerator up to a maximum of 18 h.^{8–10,12,13}

PPD fluid for mantoux test should be preserved at 2 to 8 °C in refrigerator & not at room temperature.¹¹

- Timing of examination & reading the result

CSF should be examined for cell count at the earliest, usually within 30 min. If it is examined late for cell count, it shows low cell count due to lysis of cells.¹⁴

Mantoux test reading should be done after 72 h with its maximum induration. The erythema developing in first 24 h should not be mistaken for positive reaction. If the test is positive, it can be read up to 7 days.¹¹

3. Treatment received before collection of samples

Before interpreting the test, the medicines received by the patient before collection of specimen should be taken into consideration. Anti-malarials given before preparing peripheral smear for malarial parasites may not show presence of parasites in spite of malaria. Antibiotics received by the patient in a suspected case of UTI, acute bacterial meningitis & enteric fever, before collection of samples for culture & various testes, makes difference in their interpretations.

- Interpretation of Investigations with reference to clinical & epidemiological background

Just to perform the laboratory investigation without any clinical or epidemiological reference is absolutely irrational.

Table 1 – Containers for collection of specimens for specific investigations.⁷

Container	Investigations
EDTA Bulb	CBC, PS examination, Blood group, ESR, Fetal Hb, Direct Coomb's test, reticulocyte count etc
Plain bulb	S. Widal, CRP, Liver enzymes, S. Creatinine, S. Electrolytes, ASO titer, Indirect Coomb's test etc
Flouride bulb	Blood sugar, CSF for sugar estimation
Heparin	Ammonia
Citrate bulb	PT & all coagulation tests
Test tube with glass pieces	Sickling test
Media bottle	Blood culture

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