

Game Changing Biomarkers in Chemical Pathology - That Reshaped Diagnostics

Sibtain Ahmed*, Saher Shafiq

Chemical pathology studies the biochemistry of physiological fluids, including urine, blood, and cerebrospinal fluid. A change in the body's chemistry is a sign of many illnesses¹. Laboratory experts can diagnose diseases and suggest treatments by monitoring and analyzing bodily fluids to determine whether a patient's organs function correctly. This field gained momentum in the 19th century². It is now undeniable that laboratory data are necessary for many clinical diagnoses. Many of the clinical decisions cannot be made without its input. This letter addresses the overreaching contribution of some recent tests to clinical decision-making and how they have proven to be a game-changing element in patient diagnosis and care. The four essential tests include HbA1c, cardiac troponin, procalcitonin, and brain natriuretic peptide.

Troponins are proteins in cardiac tissue that help to regulate muscle contraction. The three subunits of the troponin complex-troponin C, troponin T, and troponin I- control the contraction of striated muscles². Damage to the cardiac cells can lead to the release of cardiac biomarkers in blood. There are assays utilizing high-affinity antibodies that specifically detect cardiac troponin T (cTnT) and cardiac troponin I (cTnI) currently accessible. High-sensitivity assays can detect troponin at significantly lower levels, allowing for the quantification of previously impossible concentrations to catch with earlier assay methods. Though specific, ECG is not typical for MI because troponin assays are used for its diagnosis³. The heart score, which utilizes the clinician's judgment, patient risk factors, ECG findings and troponin level, is widely used to determine the patient's risk level. Troponin levels can help to distinguish between NSTEMI and unstable angina³; this leads to a correct diagnosis of patients who otherwise would have been labelled as having unstable angina and discharged without appropriate treatment. Diagnosis of AMI can be made when levels of hs-cTnT are higher than the 99th percentile⁴.

Dysglycemic status, which includes prediabetes and diabetes, is known to be a significant risk factor for complications⁵. During prolonged hyperglycemia, the excess glucose binds with hemoglobin non-enzymatically to form glycosylated hemoglobin

(HbA1c). HbA1c in your bloodstream reflects your average blood glucose levels over the past 2 to 3 months. This test has brought a significant advantage by not only aiding in diagnosing diabetes but also in characterizing different dysglycemic entities. It is also helpful in monitoring medium-term glycemic control in patients. It shows less biological variability and does not require fasting, giving it an edge over fasting glucose levels and revolutionizing diabetic management⁶. HbA1c would help in the early diagnosis of prediabetes patients, which would have been left out if plasma glucose alone was used, hence ensuring early treatment. Making the thyroid hormone calcitonin produces procalcitonin; it is typically delivered in small amounts in the blood by unique cells in the thyroid gland called C-cells. When your body experiences a severe bacterial infection, various cells in different parts release a substance called procalcitonin into your bloodstream⁷. A high procalcitonin level in the blood indicates a potentially severe infection or a condition known as sepsis. Healthcare professionals use procalcitonin levels as a valuable biomarker to help diagnose and monitor infections and guide appropriate treatment decisions. Multiple scales have been proven ineffective for early diagnosis of sepsis and are instead helpful for predicting prognosis. Studies have shown that procalcitonin is valuable in diagnosing and managing sepsis⁸. Prompt and effective treatment can lead to decreased duration of therapy and short hospital stays, inevitably leading to fewer nosocomial diseases and effective health cost reduction.

Cardio myocytes secrete a natriuretic peptide in response to stretch to the cardiac walls. It has various autocrine and paracrine functions, including vasodilation and natriuretic diuresis, and prevents ventricular fibrosis and cardiomyopathy⁹. A recent meta-analysis by Pufulete et al. found that BNP-guided therapy helped lower the number of subsequent heart failure readmissions by almost 20%¹⁰. BNP and NT-proBNP appear to have similar diagnostic values and can be helpful in the diagnosis of cardiac failure in elderly patients experiencing acute dyspnea. Hence, this test picks up those patients who otherwise would have been missed, and further diagnostic tests can be performed to evaluate the patient better.

In summary, the significance of laboratory medicine is paramount, and its influence on patient care and clinical decision-making is irrefutable. Moreover, in the era of AI, its significance not only endures but also

¹ Department of Pathology & Laboratory Medicine,
Aga Khan University Hospital Karachi, Pakistan
Correspondence: sibtain.ahmed@aku.edu
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evolves with the advent of new technological advancements.

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