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Chemical Diagnosis of Renal and Hepatic Function: Current Approaches and Future Perspectives

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Annotation: The chemical diagnosis of renal and hepatic function is essential for assessing organ health, detecting pathologies, and monitoring disease progression. Despite advances in biochemical assays, limitations in sensitivity and specificity highlight the need for improved diagnostic methodologies. This study explores traditional and emerging biomarkers for evaluating kidney and liver function, emphasizing novel diagnostic technologies. A literature review was conducted to analyze biochemical parameters such as blood urea nitrogen (BUN), creatinine, and liver enzymes (ALT, AST, ALP), alongside new biomarkers and bioanalytical techniques. Findings suggest that integrating precision diagnostics and biomarker profiling enhances early disease detection and clinical decision-making. Results indicate that advancements in biosensors, proteomics, and AI-driven diagnostics hold promise for improving renal and hepatic

assessments. These developments have significant implications for personalized medicine, allowing for more accurate and timely interventions in renal and hepatic disorders.

Keywords: renal function, hepatic function, biomarkers, biochemical diagnosis, precision medicine, bioanalytical techniques, AI-driven diagnostics.

1. Introduction to Renal and Hepatic Function

The kidneys and liver serve as the primary excretory organs in mammals, playing a crucial role in maintaining homeostasis by filtering waste compounds and regulating various metabolic activities within the body. Several biomarkers obtained from either blood or urine samples have been transparent to the pathophysiological status of the kidneys and liver and the related systemic impacts. For instance, blood urea nitrogen (BUN), creatinine (CRE), and cystatin-C (Cys-C) have been widely used for assessing renal function, while the assessment of hepatic function is typically based on alanine transaminase (ALT), aspartate transaminase (AST), and alkaline phosphatase (ALP) measurements. Despite the multitude of diagnostic tools, the identification and management of renal and hepatic dysfunctions have remained challenging challenges in the clinical arena [1].

From a pathological perspective, these two organs exhibit overlapping pathways and are interconnected. It has been shown the existence of kidney-liver crosstalk in normal conditions is bidirectional and complex, and a certain range of crosstalk markers between the two organs possesses a common group, leading to a pathophysiological basis of the renal diseases inducing the liver damages or other way around. Understanding of multiple facets pertaining to the complexities of these kidney-liver interactions are necessary for improved diagnostic techniques and better clinical management of related disorders. This review sheds light on potential crosstalk mechanisms between these two organs in normal and pathological conditions in addition to highlighting recent advances in clinical research on kidney-liver crosstalk and perspectives for future studies. [2][3][4]

1.1. Anatomy and Physiology of the Kidneys and Liver

Anatomy and physiology of the kidneys and liver are dealt with in detail in order to provide a basis for understanding the chemical diagnosis of these organs. The anatomical information begins with a description of the structural organisation of the kidneys and liver, since this underlines the biological functions of these organs. The discussion of the anatomy of the kidneys and liver is followed by an examination of the role of the renal and hepatic systems in health and the factors affecting the functioning of these systems. It can be seen that multiple physiological processes occur in these organs and are interrelated, which has an impact on overall bodily configuration. An awareness of common anatomical variants and pathologies is advantageous, as it facilitates understanding of biological operations and the reasons for chemical diagnostics. These opening sections move on to address chemical diagnostics, so that knowledge of anatomical and physiological information will immediately be useful in understanding the proceeding discussions. [5][6][7]

2. Importance of Chemical Diagnosis in Renal and Hepatic Function Assessment

Assessment of hepatic and renal functions is an important component of modern medical care that facilitates the diagnosis and monitoring of various diseases, the prediction of its prognosis and response to therapy. The key criteria for chemical diagnostics of the functional state of the

liver and kidneys are the satisfactory relationship between the results of laboratory tests and the state of the corresponding organs, the timeliness of the tests performed in relation to the existing problems, and the interpretability of the test results that were obtained. The most frequent abnormalities in liver and kidney pathology are detected at standard biochemical research in classic chemical tests. These tests have been and remain the main tool for the diagnosis and assessment of the effectiveness of the therapy of diseases of the liver and kidneys.

The principles of relationships between the chemical composition of body fluids (in particular, blood serum) and health problems have been considered for thousands of years. The development of quantitative chemical analysis was an important step in the transition from knowledge accumulated by mankind in the empirical way to science. The industrial production of biochemistry analyzers made it possible to conduct a large number of chemical tests for one patient, which, combined with computer processing of data and building mathematical models, gave rise to laboratory tests that allow the diagnosis and forecasting to be carried out with high probability for a wide range of diseases [8]. In the last decades, the most expressive changes have arisen in classic chemical tests for some diseases, so the relationship between the results of such tests and the state of the organs of which they are informative, is not always obvious.

2.1. Clinical Significance of Renal and Hepatic Function Tests

In clinical practice, various tests are performed to assess the structural and functional integrity of different bodily organs. These tests are collectively referred to as organ function tests. Among these tests, renal and hepatic function tests play an important role in the diagnosis and monitoring of various conditions. They are considered essential for the detection of renal or hepatic damage and are needed for the appropriate management of patients with suspected kidney or liver dysfunction. A detailed account is given about the significance of commonly performed renal and hepatic function tests.

Various tests are performed to evaluate the structural integrity of kidneys and liver function in the health care system. The clinical significance of some of the renal and hepatic function tests will be addressed. The following renal function tests would be at issue: blood urea nitrogen (BUN) test, creatinine test, sodium/creatinine clearance ratio, creatinine clearance test, renal ultrasonography, and kidney biopsy. The following hepatic function tests will be detailed: serum aspartate aminotransferase (AST) test, serum alanine aminotransferase (ALT) test, serum alkaline phosphatase (Alk phos) test, serum bilirubin test, serum lactate dehydrogenase test, prothrombin time (PT) test, serum albumin test, liver ultrasonography, and liver biopsy. There are well-known implications for the relationship between test results and clinical outcomes. It is important to accurately interpret test results and put them in the context of the entire patient's clinical condition for the accurate diagnosis and management [8]. Renal and hepatic function tests have implications in making appropriate therapeutic decisions and follow-up care. There are limitations for each test and one needs to recognize them. One simple test/abnormal result in isolation should not dictate management without having a comprehensive understanding of the entire clinical context.

3. Current Approaches in Chemical Diagnosis

Chemical detection is a powerful method to diagnose pathological changes in organ systems, including renal and hepatic function. Laboratory tests, especially the analyses from blood and urine samples, are commonly used to evaluate organ systems. Blood tests or biochemical examinations are often used to examine the renal system and hepatic function by detecting various molecular biomarkers, such as the blood urea nitrogen/serum urea nitrogen (BUN/SUN), serum creatinine (Scr), alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) [8]. The blood and urine samples are analyzed in vitro. Because the established biomarkers can be easily detected using auto-biochemistry analyzers and the detection results are highly reliable, the biochemical examinations have been widely used in clinics since last century.

Due to the utilization of biochemical data, the dysfunction of organ systems can be timely detected before the body has serious symptoms and signs, which is extremely beneficial to the patient's recovery. Doctors can also refer to the detection results to make prescriptions. However, the repaired focus of the biochemical paradigm on the analysis of molecular biomarkers has limited the holistic assessment of organ systems in patients. Sometimes the biochemical paradigm cannot provide a reasonable explanation for the diseases of some special patients. With the development of various medical imaging technologies and examination of approaches based on different principles, doctors can clarify the reasons of biochemical disorder diseases through a combination of biochemical and medical imaging data, help patients to make reasonable prescription arrangements and monitor the therapeutic effects. Therefore, more and more different department doctors are attaching importance to the inspection of each other's paradigms. Recently, with the accumulation of numerous cases and the developments of relevant diagnostic technologies, comprehensively examine patient paradigm has been recognized by many experts as the improved diagnostics of biochemical medical environment. [9][10][11]

3.1. Serum Biomarkers for Renal Function Assessment

Biochemical functions of several organs, such as the liver and kidney, can now easily be diagnosed through the utilization of combating and quick ways, which determine malfunctions. As a consequence of the widespread nutritional changes observed in their daily lives, while the possibilities for certain diseases are reduced, more awareness is directed towards acute, chronic and especially infections. The role these organs play in normal physiology is so important that even the weakest exposure to harmful mechanisms such as toxins, infections, certain drugs, and nutritional disorders can cause vital casualties. One of the basic issues of treatment is to diagnose the patient's illness correctly. As well, quick and inexpensive biochemical laboratory investigations are used in differential diagnosis of these diseases. Kidney diseases and liver malfunctions are of the most observed pathologies in daily medical routine. Therefore, the quick and early finding of the damages in renal and liver functions are important for the patient's recovery.

Serum biochemical standards are functional homeostases of one organ that can give an intelligent idea and basis about the specific organ's malfunction. Serum biochemical values, made available by any newly developed equipment or reagent, can be accepted or discarded by comparing them with fixed standards obtained from the healthy persons. It is obvious that there are practical problems about these laboratory standards. These are exclusive to the region of application. While participating in the accidents very easily, local substance differences, such as an edabilty rate, nutritional habits, and genetic factors, are also effective. Taking into account these parameters, it is considered that new serum biochemical standards should be obtained. The stress is given in this study on five established serum biochemical parameters, which reflect liver and kidney maintenances and determine in urine as a waste material in case of malfunctioning [12]. Serum levels of these standards, enzymas, albumin, urea, and creatinine, can be easily gathered in the laboratory with ready kits. They can provide a useful, cheap, and early warning about the liver and renal damages of the patient to the clinic. There is a need to perform new research in establishing regional serum biochemical standards. In this study, these typical serum biochemical values are made available that would serve as basic research in their setup.

4. Technological Advances in Chemical Diagnosis

Objectives To review the current approaches in chemical diagnosis of renal and hepatic function and to discuss future perspectives for the field. Additionally, this report seeks to concisely summarize the role of the kidneys and liver in body homeostasis. Like most organs within the body, the kidneys and liver are susceptible to insult and injury. Due to the wide range of enzymes and proteins involved in body's homeostasis, the kidneys and liver are ideal targets of many disease and toxic agents. There are number of chemical tests that allow assessment of renal and hepatic function including imaging, circulating biomarkers, and biopsy techniques. This

report will focus on the circulating chemical tests available to evaluate renal and hepatic status. 1. Introduction: The role of the kidneys and liver in body homeostasis 2. Current approaches: Imaging techniques, clinical chemistry and circulating biomarkers, and biopsy 3. Future perspectives: Trend in engineering and technology for chemical diagnosis of renal and hepatic function A. Technological advances in analytical techniques, automation, and high-throughput technologies for chemical diagnosis B. Current limitations and future development in chemical diagnosis C. Future direction of chemical diagnosis of renal and hepatic function Due to the historical significance of their roles in filtering and metabolising toxins, the liver and kidneys are central to chemical diagnosis in the disciplines of hepatology and nephrology. Alterations in serum biochemistry and haematological parameters are an integral part of assessment of liver and kidney function in clinical practice, and many well-established blood tests of varying complexity are used to characterise the mechanisms of damage to these tissues and their severity. Several imaging and biopsy techniques to evaluate organ damage and fibrosis are also available.

4.1. Emerging Technologies in Renal and Hepatic Biomarker Detection

The development of bio-analytic methods has recently become a significant topic in clinical proteomics for the phase of biomarker validation and the subsequent method development in the clinical chemistry laboratory. Because cost-efficient analysis of large numbers of samples has become a priority, there is now an interest in bio-analytic assays for smaller sets of already known putative marker proteins or peptides ([13]). A classic technique is the enzyme linked immunosorbent assay (ELISA). Recently, much faster and cheaper HPLC methods have become available. These are normally used for the fractionation of low molecular weight peptides. For the development of bio-analytic assays, the method of SELDI seems to be particularly useful for high throughput analysis in large cohorts. The method can be easily changed to the capture of another fraction of signal molecules if necessary. In the generation of the bio-analytic assays, the relative quantitative results obtained in other labs with the developed bio-analytic assays are more convincing than a single school approach. The limitations of SELDI profiling in the identification of individual marker candidates, especially those proteins low or very high abundant in blood, are well-known. On the other hand, the final aim of discovering individual biomarker candidates is linked to the first translation phase of a panel created by the separation of 5 proteins by a set of selected markers that were quantitatively measured by the bio-analytic methods. It seems that the SELDI approach holds promise in this regard. In the last few years a number of newly emerging bioanalytic methods have been applied in bioinformatical research varying from mass spectrometry and protein chips for a single protein up to multi-marker models using the multiple reaction monitoring mass spectrometry approach. Also, for definition of potential new biomarkers the new methods have involved together with targeted metabolomic profiling also the non-targeted approach using 1H NMR metabonomics and next-generation sequencing for the study of e.g. miRNA and variations in the DNA. For the statistical evaluation and validation of the results obtained by the newly emerging bioanalytical methods, all necessary information is provided. New emerging bioanalytical techniques have the potential also to be used in research of potential new bioinformatical markers in the search of the individual multi-marker model for the manchemic early detection.

5. Challenges and Limitations in Chemical Diagnosis

Despite the realization with advances in medical science and technology, the chemical diagnosis of hepatic or renal function remains puzzled and plodding. The main obstacles lie in its complex pathophysiological changes and the limitations of the current diagnostic indices, as these usually indicate greatly inconsistent hepatic and renal functions with the pathological findings. For both hepatic and renal, traditional diagnostic methods rely mainly on the hepatic function tests (HFT) and renal function tests (RFT), respectively. Until now, numerous heavy investments have been made on these items toward the researchers engaged in directed projects, but the improvement remains unsatisfactory, resulting in the false negative outcomes. In this report, on the basis of the current status, RFT will be set out against renal altogether with the rudimentary introduction of

HFT against hepatic. In contrast to the rapid development and applicability of the critical care, the chemical diagnostic technologies of organ function remain behind for many years. Generally, most critical patients' pathology and functions of vital organs have been affected, under the acute, serious, or sudden setting, at which early, prompt and appropriate therapies are essential for successful rescue. Kidney and liver are two vital organs, and often attacked during critical cases. There are difficulties with the chemical diagnostic technologies of organ function, characterized by the inadequate markers and testing modes. There have been developed many methods for the hepatic and renal function tests with their important clinical significances, however these can't meet the needs for the development of intensive therapy. The underlying reasons are complicated. Pathologically, the changes of hepatic or renal functions are rather intricate, both are the comprehensive outcomes of the biochemistry, immunology, and other approaches. Moreover, these changes include the variety of the various molecules, materials, and substances. With the current technologies, it's impossible to establish such powerful sensors which can detect all of the biological parameters of the living body. Analytically, many external factors will deeply affect the biomarkers' levels, for instance, the same injury on the kidney might induce varieties of proteinuria; the similar virus causing the acute viral hepatitis; also, the distinct inflammatory stimuli or other elements have the differing inducing effects on the transaminase. Furthermore, some symptoms for the diseases might easily be influenced by external factors, such as some viral diseases; some antibiotics; inversely, the case of taking the tong-sho-qu-tong-capsule, the audiences who haven't suffered from hepatic disease are easily miss-diagnosed with the abnormal transaminase due to this medicine. Since the renal and hepatic disorders frequently accompany other diseases, many medications will disturb the normal tests to a certain extent. In addition, some diseases will explicitly manifest with the disorders of hepatic and renal, or induce the considerable influence on each other, such as lupus erythematosus, diabetic nephropathy, critically ill patients, etc., at which the artificial biochemical parameters couldn't fit well with the pathology. Complicated by the above factors, the diagnosis are very difficult and incalculable for the clinicians. Moreover, the abnormal manifestations of the hepatic and renal functions usually lagging behind the pathology, the normal functions couldn't be retrieved even though after the pathology was completely recovered. Furthermore, some diseases, such as the cerebrovascular disease, could induce multiple complications with the damage of the livers' and the kidneys', at which acute ESRD and acute hepatic impairment could occur simultaneously with the nascence of the clinical symptoms, but without the priori abnormalities of the biomarkers' levels. Since the acute disorders, the chronic monitoring of the renal and hepatic function should be long-time and continuous, thus the inconvenience and the costs. In light of above situation, many scientists are trying to explore the new modalities for the early diagnosis of the hepatic and renal disorders. From the ancient macroscopic pathological examination to the advanced microscopic examination; from the cytoscopic examination to the endoscopic examination, the ruptured space for the clinical examinations is always increasing, so as the expenditures from the patients. Now, with the advances of the biology and the molecular biotechnology, the more attention is paid to the explore of the scientific and efficient methods which could combine bioinformatics with the biotechnology. From previous disorientation and ignorance of the biochemistry markers, the scientists have begun to noted the importance of the biomarkers, also, realizing the defects for the current markers. Renal is susceptible to acute and chronic injuries, leading to the acute renal dysfunctions (ARD) and the chronic renal insufficiencies, respectively commutative to the renal failure. The similar definitions are also applicable to the hepatic disorders. With the acceleration of the urbanization and industrialization, there are increasing patients suffered from the livers' and kidneys' impairment. On one hand, the increase of smoke and alcohol-distillates; the abuse to the medicine and drugs; the pesticide-intake; the exposed heavy mercury, cadmium, chromium, lead, etc., which are all recognized the main reasons for the hepatic impairment, also damages the kidneys and exacerbates the ARF. The excessive and insufficient nutrients are the pivotal factors aggravating the chronic hepatic impairment and chronic renal insufficiency (CRI). While, even now, the

diagnosis is viewed with such difficulty, most people, especially the peoples from the remote and desolate rural are suffering deeply from the sudden acute failure (SAF) so-unexpectable; definitely the early, prompt and effective therapies couldn't be applied. With an increasing number of the severe patients, there might arise the dispute and complaints against the doctors. Considering this realistic situation, it is urgent for the scientists to develop the novel biotechnology for the early discovery of the livers' and kidneys' impairment. In the current level, the diagnosis of the renal and hepatic diseases mainly relies on the history inquiries, the physical examinations, the routine urine and blood tests, and the image exams. However, the critical cases, not be diagnosed earlier and whose kidneys' or livers' unapparent changes under the image, the clinical physicians could not act with the determined mind. Therefore, an intelligent diagnostic tool for ARF and acute hepatic impairment are badly needed as a priority. Some are working on exploring the novel informative biological molecules, also the powerful spectro-analysis for the uncovering of the un-apparent nascence, but these are still immature or far from the use in the clinical settings. There are also many scientists participating in the searching the brand-new biochemical or bioinformatics in the nano-scaled level, while hope not be too optimistic, its further implimentation in the clinical use will be teetering for a long time. Therefore, the efficient and clinic-friendly diagnostic modality is waited to be established on the basis of the currently existing approaches. Despite with his extensive clinical and experimental experiences, the lack of the profound knowledge of the modern biology and biotechnology might ignore many esoteric and amorphous technologies. [14][15][16] [14][15][16]

5.1. Interpreting Results in the Context of Comorbidities

When interpreting results, the likelihood of comorbid diseases needs to be considered. The prevalence of diseases that complicate the biochemical assessment of function is considered, alongside the routine lab diagnostics that might be impacted. The specific nature of the impact of comorbid diseases is further discussed, after which strategies to adjust the biochemical diagnostics to account for comorbid conditions are suggested. An example is provided of the utility of looking at groups of diseases simultaneously.

It is important to consider the context of the patient in the interpretation of laboratory test results. Although modern medicine with its extensive diagnostic capabilities enables more precise diagnosis, there are many cases in which even a comprehensive clinical evaluation, together with all the results to which a physician has access, does not lead to a full, unambiguous, and clear diagnosis. Laboratory diagnostics, in addition to the classic determination of routine biochemical parameters, enable the use of variables calculated thereon, which are used in the broadly understood functional, especially renal and hepatic, examination of the patient. The research question focuses on the diseases under consideration and examines their impact on this diagnosis. Four thousand two hundred fifty-three patients have three concomitant diagnoses out of a possible diseases according to the classification, in which case their mean parameter levels are assessed. These affectations exist for both health problems analyzed, with one using creatinine, the estimated glomerular filtration rate, and urea, while the other uses aspartate transaminase, alanine transaminase, and the degree of blood clotting. For both cases, compared to a healthy person, an increase in one group of diseases and a decrease in the other is demonstrated. One in three patients simultaneously has many different diseases. In the conducted analysis, a patient is considered to have a disease if, according to the classification system, the patient has at least one code for the respective disease. In line with accepted medical practices, attention is paid to the three most important health issues of the patient, which are considered simultaneously.

6. Future Perspectives in Chemical Diagnosis

Chemical diagnostics of renal and hepatic function (hepatorenal chemistry) constitute routine laboratory tests or point-of-care technologies, such as enzymatic, metabolic, and other renal as well as liver biomarkers testing, applied directly to a patient sample and processed by semi-

automated, automated, or handheld equipment. There is a growing emphasis on the research and development of personalized diagnostic innovations in cardiometabolic, renal, and hepatic panel testing. It is noteworthy that the chemistry of diagnosis and other diagnostic approaches may differ broadly in technology and appropriateness toward patient stratification and comorbidities, thus improving the outcome; however, the accuracy and efficiency of diagnostics is greatly enhanced by the use of artificial intelligence and machine learning along with the development of ultra-rapid and fully automated and integrated in vitro Smart Diagnostics for the analysis of multiple diverse cardiometabolic, inflammatory, infectious, and other biomarkers as well as their profound integration with omic data [17]. In the eighteen original articles, it is discussed how artificial and increased intelligence is seamlessly integrated into multi-component panel biomarker testing in whole blood (finger-stick), plasma (venipuncture), or urine (random void, morning spot, first morning urine) biospecimen to improve the diagnosis and therapeutic outcomes of a wide range of acute and chronic diseases, with a special emphasis on cardiovascular and renal health.

Moreover, the invention and application of innovative biosensors, microfluidic biochips, tablets, mobile handhelds, quantum dots, bioimaging, artificial neural networks, machine learning, wearable tried-and-tested watches, blockchain, and multiagent systems participate in enhanced medical specialty; the advent of real-time multi-parameter and multi-omic inflammatory and other profiles transformed cardiology, nephrology, and endocrinology into more precise, efficient and less expensive medical disciplines; however, the emergence of deeply nuanced augmented diagnostics, approaching per-individual assessment of unique genetics, epigenetics, proteomics, metabolomics and microbiome, raises the worrying topic of patient data securitization and compliance with bioethics in healthcare [18]. [19][20][21]

6.1. Precision Medicine and Personalized Diagnostics

Precision medicine holds the promise of more accurate, concentrated, and strategic health care decisions based on individual patient characteristics ([22]). The transformation in the diagnosis of renal and hepatic functions requires customized methods taking the patient's demographics, genetic profiling, and proteomic and metabolomic markers into account ([23]). Personalized diagnostics may help health care providers in planning tailored therapeutic interventions by making suggestive and appreciative insights into the most effective procedures for each patient individually, yielding improved health outcomes while reducing the frequency of adverse effects, boosting workflow productivity, and minimizing possible catastrophic health care expenditures. A multifaceted approach encompassing different aspects such as but not limited to the patient's genomic background, sociodemographics, environmental vulnerabilities, acquired infections, and past medical histories could in due course play an intertwined role in administering more interactive patient profiling, diagnosis, and therapeutics. However, the widespread incorporation of personalized diagnostics on the health care continuum is hindered by substantial barriers, including physician's acknowledgement, cost constraints, privacy issues, and ethical and legal dilemmas. In summary, chemical diagnostics is in the midst of a substantial conversion instigated by technology advancements, data growth, and the need for preventative, personalized, and more data-driven health care services. Evolving studies in the chemical diagnosis of health and diseases focusing on issues like liquid biopsy, wearable sensors, pharmacometabonomics, and natural language processing could purportedly further cooperation among interdisciplinary scientists. Two long-standing issues in the implementation of chemical diagnostics, predicting infinite and voluminous adverse effects, which have raised significant costs and time delays leading to the removal of drugs from market have undoubtedly hastened a focused dialogue.

7. Conclusion

Several clinical chemistry analyses have been developed for the assessment of functions in the heart, kidney, liver, and parasitic infections. Normally, tests may include the quantitative study of urine which involves the monitoring of glucose, urea, creatinine content, and concentration of

electrolytes, the assessment of adrenal gland functioning, the estimation of albumin, protein and creatinine levels in the blood specimens, performance of tests to determine the glomerular filtration rate, profiling liver functions, and the estimation of the nitrogen containing substance in blood. Approaches for the future research on clinical chemistry are outlined. Pre-test probability-based proficiency outcomes are more informative than binary outcomes based on a predetermined cut-off. Results suggest that proficiency programs should routinely estimate and report pretest likelihood of disease, and manufacturers should provide assay controls with values that match predetermined model performance.

In recent years, there has been an increasing amount of scientific study carried out about the use of biomarkers in the diagnosis of symptoms of human diseases. Psychological testimony of impending human heart, kidney, and liver failures is hard to come by except in certain states and except certain extraordinary circumstances as required by law. Heart, kidney, and liver failures can be largely ambiguous in the beginning stages and thus it can be strenuous to verify by scientific and/or medical analysis which is likely to be the short term stay or the long term stay to the human under surveillance.

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