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Editorial

Artificial Intelligence Driving Diabetes Care

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Abbreviations

CT - Computed Tomography
AI - Artificial Intelligence
MODY -Monogenic Diabetes
CGMs -Continuous glucose monitors
IPEX - Immune dysregulation polyendocrinopathy enteropathy X-linked

Introduction

Artificial intelligence (AI), a technology reshaping healthcare, is used to investigate, gather data and draw conclusions from electronic medical records and imaging procedures. AI has been shown to aid in identifying, categorizing, diagnosing, and managing diabetic mellitus [1]. It will likely continue to do so with a clear understanding and the ability to find previously unidentified solutions [2]. AI has a role in diabetes helping to anticipate the diagnosis, provide nutrition and exercise goals, monitor complications, and assist with self-management [7]. We may now see the management of diabetes and other chronic diseases from a new viewpoint thanks to the expanded use of continuous glucose monitoring and the identification of patterns in glucose fluctuation known as glucose variability [3]. It has paved the way for in-depth research into the many new factors that affect managing diabetes such as socio-economic factors, sleep, and activity [1,2].

Redefining Diabetes Care

With electronic medical data, artificial intelligence has allowed us to shape and address the necessary preventive treatment by understanding and predicting people at high risk of acquiring diabetes [2,4,7]. The classification and accurate prediction of diabetes in an individual may change soon with the thorough densities. A non-invasive method of anticipating and diagnosing the illness is now possible thanks to more precise and defined imaging advancements [13,17]. Recently there has been use of more CT, MRI imaging modalities are being used more when compared to traditional imaging modalities as it is able to provide more enhanced images showing more detail of metabolic function and coronary anatomy by using imaging like MR spectroscopy, 3D intravascular ultrasound, and optical coherence tomography [18].

Conclusion:

AI is being used as a therapeutic and instructional tool that is and will revolutionize how diseases are managed for years to come. Machine learning is a tool that carries strategic weightage by carrying detailed analytical data in different forms in addition to clinical care that has been revolutionary in the incorporation of precision medicine, whether with CGMS discovery and implementation or through advancements in imaging modalities to screen, manage complications of diabetes. To lessen diabetes disease burden and aid in reducing morbidity associated with diabetes, AI use has integrated diagnostic and therapeutic roles with use of thorough analysis and algorithms that only increase the accuracy of management in diabetes care while also filling in the gaps that were missed previously. Focusing on precision medicine practice and treatment has tailored new innovative treatment goals towards individuals' particular data and surveillance. It is inclined to focus on collaborative efforts that have proven incredibly strategic and is an advancement to medical practices that is taking precedence. Artificial intelligence is transforming how diabetes is understood and managed by way of making new analysis that has paved the way to new focus of precision medicine care.

examination of multiple glucose levels and analysis of CGM readings [4]. Predicting prediabetes and diabetes at an earlier stage in more patients using strict glycemic trends, risk factors, and focusing on adapting precision therapy may become a reality in primary care settings [5].

With the aid of AI, genetic testing, and advances in autoantibody testing, mutations in genes that cause MODY (monogenic Diabetes) and genetic syndromes (K-ATP channel mutations in KCNJ11, ABCC8, GATA6, and FOXP3 mutations that cause a monogenic form of autoimmune Diabetes, as part of IPEX syndrome, and GATA6 and PDX1 mutations needed for pancreatic development) can also be discovered [10,19]. With these techniques, what was previously only categorized as Diabetes of neonatal or childhood onset has undergone a paradigm shift in terms of diagnosis, care, and in some cases, the identification of potential research medicines [4-6].

Dietary Algorithms

AI has influenced dietary modifications and made it possible to analyze how carbohydrates, protein, and fat affect glucose patterns. Since the impact of carbohydrate intake on blood glucose levels has been demonstrated, dietary recommendations for diabetic individuals have shifted based on various factors that vary from each diabetic individual [2,4,5]. A proposal for diabetic diets has been created by making it possible to determine the number of carbohydrates required to raise blood glucose levels and the amount of protein and fat needed to lower blood glucose levels [3,5,9].

For those with type 1 diabetes, the introduction of insulin pumps and continuous glucose monitors (CGMs) has made it possible to anticipate the amount of insulin to take with each meal based on the needs of the specific patient for managing diabetes care. This formed the crucial components for the development of the artificial pancreas [5].

A simultaneous discussion about a patient's diet diary can be receptive to the doctor and the patient to analyze individual reactions. AI has already paved the door for dietary intervention in Diabetes by analyzing an individual using CGM [7]. It is possible to comprehend in great detail each pre-meal diet and its impact on glycemia, compliance with diabetic diet interventions, understanding of food intake timing in relation to blood glucose, the impact of diet deviation

Keywords: Artificial Intelligence, Diabetes, CGMS,Precision Medicine, Glucose Variability, Machine Learning, Diabetes Management.

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on blood glucose, the effects of fasting and overeating periods on blood glucose levels, and much more [8,9].

CGM And Blood Glucose Variability Prediction

We can now predict glycemic control conditions like hypoglycemia and hyperglycemia using artificial intelligence and continuous glucose monitoring [18]. Continuous glucose monitoring has been a breakthrough in the precise understanding and analysis of individual blood glucose swings as compared to conventional methods of blood glucose level monitoring [3,4]. Without AI and the aid of CGM, there would not have been a significant amount of data collected between what is typically measured in the lab (fasting and postprandial glucose levels), a thorough evaluation of the individual responses to medications, prediction of a low blood glucose level based on trends, response of glucose levels in periods of fasting, exercise, stress, diet changes and so on [5,9]. The ability to set an intervention such as an alarm in the device or app to notify the individual has been transformative for individual patients to be informed about trends that are likely to occur [9].

The concept of glucose variability, which focuses on blood glucose levels between other readings, is another crucial aspect of precision diabetes. With AI, it is now possible to recognize the significance of glucose fluctuation and its unique function in oxidative stress and fat accumulation [11]. Previously, diabetes education primarily focused on diet, lifestyle management, and the emergence of diabetes-related morbidity. We now understand that socioeconomic factors, dietary factors, menstrual cycles, sleep patterns, stress levels, and habits like drinking or smoking may significantly impact glucose fluctuation [9,12]. Studies showing that glycemic variability that is below 12% support the importance of minimizing change that has been linked to fat accumulation [13,14,16].

Patients who experience the Somogi effect and the Dawn phenomenon have been identified using CGM and the action of counterregulatory hormones in these phenomena can be interpreted through the data [20]. By data which shows a visual pattern with colors and easy distinctions, a form of motivation and effective communication has also occurred allowing for a strategic mode of patient care promoting effective care [20]. By distinguishing between the two products and delivering prompt intervention to adjust food and administer therapeutic intervention, it has proven to be very effective [13].

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This vast amount of data is a valuable and essential tool in identifying specific interventions for lifestyle modifications and therapeutic value, especially when combined with individual patient activity and stress levels as documented in self-reported journals [8,11]. We have been able to precisely forecast the interaction between drugs and insulin, identify alternative medications for the following line of therapy, and modify insulin levels accordingly [15].

Application In Vascular Disease

It becomes helpful in both preventive and therapeutic management with increased data collection of massive readings, predictability of diabetic vascular problems such as diabetic retinopathy with the use of comprehensive retinal fundus images, and the ability to identify stages of retinopathy [6,16]. Clinical and biochemical data can be used to forecast the onset of further microvascular issues like nephropathy or neuropathy or macrovascular complications like a cardiovascular event [9]. Similar to diabetic nephropathy, assessment of endothelial dysfunction and microvascular damage in diabetes patients' kidneys can be done using ultrasound and color doppler in combination [9,14].

A method for vascular risk stratification in cerebrovascular disease, AI has been used to identify and measure the carotid intima-media thickness and plaque area on carotid vascular images [10]. Similar to how aortic artery imaging is used to identify aortic aneurysms in peripheral artery disease, the ankle-brachial index is used to diagnose peripheral artery disease [8]. By incorporating doppler ultrasounds to pick up intima media thickness in the carotid artery, its use has also been proven value in detecting peripheral arterial disease by determining plaque diameter and filling defects [19]. By using non invasive tests to screen and manage diabetes complications a form of primary and secondary prevention can be sought owing to overall collaborative care for a diabetic individual.

Imaging And Predicting Diabetes

With the use of extrapancreatic and pancreatic CT image results, AI has also demonstrated a critical role in diagnosing and early identifying Diabetes [8]. The pancreas and the amount of visceral fat surrounding the organs can be utilized to identify individuals with and without Diabetes simply by upgrading automated clinical imaging equipment [12]. Individuals with Diabetes were also found to have lower pancreatic -

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