ARTIFICIAL INTELLIGENCE IN OBSTETRICS & GYNECOLOGY- ERA OF RECENT TECHNOLOGY

Abstract

Artificial intelligence (AI) has attracted interest due to its rapid expansion in a variety of disciplines, including healthcare. Computing systems have made significant strides in the medical area thanks to advances in theories, learning algorithms, and the ability to process large datasets. AI has found widespread use in the medical industry due to its capacity to guide physicians and practitioners in making right judgments when handling situations and diagnosing patients. Predictions are now so straightforward and precise thanks to computer algorithms. This is due to AI's ability to accurately provide information to a large number of patients. Additionally, the AI subsets of machine learning (ML) and deep learning (DL) techniques have helped identify intricate patterns in massive datasets and use those patterns to forecast future events. The use of AI in obstetrics and gynecology is discovered to be developing spellbindingly, despite many obstacles. Therefore, in order to enhance therapeutic results and experiences, this research suggests investigating the application of AI in obstetrics and gynecology. In that regard, this article clarifies the development and advancement of AI, its function in ultrasound diagnosis during different stages of pregnancy, its therapeutic advantages, the postpartum period following preterm birth, and its applications in gynecology, along with suggestions for the future.

Keywords: Artificial Intelligence, Obstetrics, Gynecology, and Recent Advancements.

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I. INTRODUCTION

Artificial intelligence (AI) refers to the digitalized computer system that imitates brain function. The neurons of brain are aligned with the several nodes, termed as neural networks, and this intelligence system is similarly systematized [1]. The use of AI in healthcare systems has significantly increased during the last few decades. It is clear from data records that by 2025, investments in AI for healthcare systems are expected to increase by a factor of 18 times.

Computer-aided fetal evaluators (CAFEs), cardiotocography (CTG), and other AI applications are used in healthcare. Technology called System 8000 is used to track episodic variations in fetal heart rate (FHR). Neural networks have also made it possible to find ovarian cancer early. The electro hysterography (uterine electrical signals) has also been used in trials to predict preterm labor [4]. In the middle of all of these, the use of AI in vitro fertilization (IVF) is a fruitful procedure in day to day practice today.

AI provides extremely certain decisions to assist practitioners and physicians in making decisions. The deaths caused by inaccurate prediction and diagnosis are by far and away the main reason AI has become so pervasive in clinical decision-making and diagnosis [5]. Therefore, by improving predictive accuracy, AI can aid in reducing such errors.

The Necessity of an AI Connection in Obstetrics and Gynecology: Obstetrics and gynaecology are among the disputed disciplines that account for indemnity payments made in response to malpractice claims. The most common disputable occurrence is hypoxia-induced encephalopathy, which is caused by intrapartum foetal misinterpretation, which is partially preventable. Gynecological oncology, where failed identification and prognosis of cancer have been a major worry, is another area where multiple poor results and obstacles have been reported [7,8]. Treatment for infertility has remained a significant problem using traditional methods. As a result, the demand for AI in obstetrics and gynaecology is rising in response to the need for higher treatment success [9].

The rapid growth of use of genetic engineering in IVF has also increased the demand for AI to improve precision. This is due to the development of precision techniques, which has made it possible to make precise predictions in the health care sector. AI-based algorithms support clinical services by addressing diagnostic challenges including efficiency and performance. Additionally, these algorithms enhance clinical vigilance in the detection and management of complex disorders, infection prevention, etc.

II. CLINICAL ADVANTAGES OF AI IN OBSTETRICS AND GYNECOLOGY

It is discussed how AI is currently used in obstetrics and gynecology to interpret CTG and FHR, help identify pregnancy problems and preterm labor, and analyses interpretational differences between physicians.

Applications of AI in Gynaecology and Obstetrics: These applications are unique in that they address recurrent problems with diagnosis and care.

1. **Using Ultrasound to Diagnose different Phases of Pregnancy:** Medical ultrasound has the potential to be used more frequently and in a variety of clinical situations with the help of AI-powered ultrasonography. Therefore, the AI use in pregnancy ultrasonography could aid doctors in classifying and diagnosing pregnant women's bodies.

   Wu et al. investigated the reliability of ultrasonic diagnosis using AI algorithms for patients with complex brain tumors during pregnancy [16]. AI-based diagnosis had a 94.50% accuracy rate, and the K-value was 0.99.

2. **AI's Importance in the First Trimester of Pregnancy:** If hypertension is present, individuals' placental pictures during pregnancy differ from those of people who do not have it. Since it is a noninvasive, economical method to advance future directions, the inferences have been proven as a marker to anticipate hypertensive disorders during pregnancy (HDP). In light of this, the study explains how AI can be used to evaluate differences in the texture of the placental ultrasound image in expectant mothers with hypertension and normal outcomes. This presents the possibility of creating a textural feature extractor module that, prior to the disease's clinical manifestation, could forecast unfavourable pregnancy outcomes[18].

3. **AI's importance During the Second and Third Trimesters:** A higher level of performance has been shown by diagnostic support tools that use AI in specific medical areas. Sakai et al. applied the unique DL-based explainable graph chart diagram representation to support foetal cardiac ultrasonography screening. Because the technique is challenging to master, fetal cardiac ultrasound screening typically has a low rate of detecting congenital heart disease in its second-trimester stages [20]. The screening performance for detecting pregnant women using AI in the second and third trimesters improves as a result, going from 96% to 97.50% for specialists to 82% to 89% for peers [21].

   Because of the foetal mobility, an algorithm that can assess changing images in real-time is required, which contributes to the rapid changes in the foetal ultrasound plane. Diagnosis using prenatal ultrasound in order to create and validate the AI system, the AI conduct system (PAICS) is proposed to identify various foetal intracranial abnormality patterns in standardised sonographic reference planes to screen for any congenital central nervous system (CNS) anomalies. [22].

4. **Preterm Birth:** Research focuses on developing an effective PTB prediction model that relies on ANNs. Numerous studies suggested that PTB in the first trimester of pregnancy might be predicted using CL sonographic measures. However, additional research is required to outline the CL's capacity to screen PTB. The ability of DL and ML to process highly dimensional patient data and their aptitude for self-learning make them superior to the logistic-regression technique[23].

5. **Postpartum:** Pelvic floor dysfunction (PFD) is another common gynaecological disorder. The main clinical symptoms are sexual dysfunction, pelvic organ prolapse, urinary loss, and fecal incontinence. From this perspective, a study examines the advantages of using ultrasonographic technology and rehabilitation instruction using an AI algorithm in the

recovery of postpartum pelvic organ prolapse[25]. As a result, AI systems have positive effects while processing ultrasonic pictures.

Additionally, a variety of consumer-grade wearable gadgets, such as smart rings and watches, might capture semi continuous physiological measurements like blood pressure, oxygen saturation, temperature, heart rate abnormalities, and normal heart rate patterns and count. They also keep tabs on other behavior indicators like sleep duration, quality, and position in relation to other patients as well as activity levels. The monitoring of these physiological factors was clearly beneficial for accurately diagnosing early pregnancy-related disorders such gestational hypertension and preeclampsia.

6. **Role of AI in Artificial Reproductive Techniques:** According to this application of AI, the key difficulty in other medical IVF streams was still choosing a viable embryo. This appears to be crucial in estimating the outcomes that would result in a shorter pregnancy period and the birth of a healthy child.

The extensive use of AI to assess patient characteristics such ovarian reserve, endocrine status, diagnosis test, endocrine status, and age would increase the efficacy of medication and detection of issues with the reproductive system[24]. These criteria support the anticipated outcomes of successful IVF through AI support and tools. To develop the ANN model effectively and maximize its prediction power, larger datasets, including computer vision, were used. Only a few other prior attempts using AI techniques to evaluate human oocytes, forecast typical fertilization, and examine the embryo's development through blastocyst (BL) stages have been made. Using static images of the oocyte, the approaches even assess the potential for implantation before and after conception. [24].

7. **Others application in Gynecology:** The use of AI in gynecology has significantly increased in the modern period due to the rise in diseases and the necessity to improve the diagnosis procedure. In that respect, a number of researchers have made use of AI's potential for prediction of disease. The latest applications of AI-based gynecological models include the creation of an anticancer medication and the identification of cervical intraepithelial neoplasia, uterine sarcoma, IVF, and endometrial malignancy.

III. CONCLUSION

The primary definition of AI is that it is the study of algorithms. Machines are already capable of carrying out and using cognitive thinking for a variety of purposes thanks to this frequent and extensive exploration. Machines are therefore capable of object recognition, decision-making, and problem solving. Obstetrics and gynecology is one of the medical fields where AI has achieved performance on par with that of human specialists. Therefore, AI could offer a lot of help in obstetrics and gynecology with technology advancement and interdisciplinary inclusion.

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