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Avicenna Research Institute (ARI)

Avicenna Research Institute (ARI)

Insights into Infertility Management :

Artificial Intelligence (AI), Challenges, and Prospects

December 11-13, 2024

Topics Discussed at the Congress:

1. The Role of AI in Diagnosis and Treatment
2. Consultation on Selecting Optimal Treatment Methods
3. Medical Ethics Considerations in Infertility Treatment
4. The Application of AI in Research
5. Challenges, Prospects, and Opportunities in Infertility Management with AI

Panberes

Collaborators: unesco

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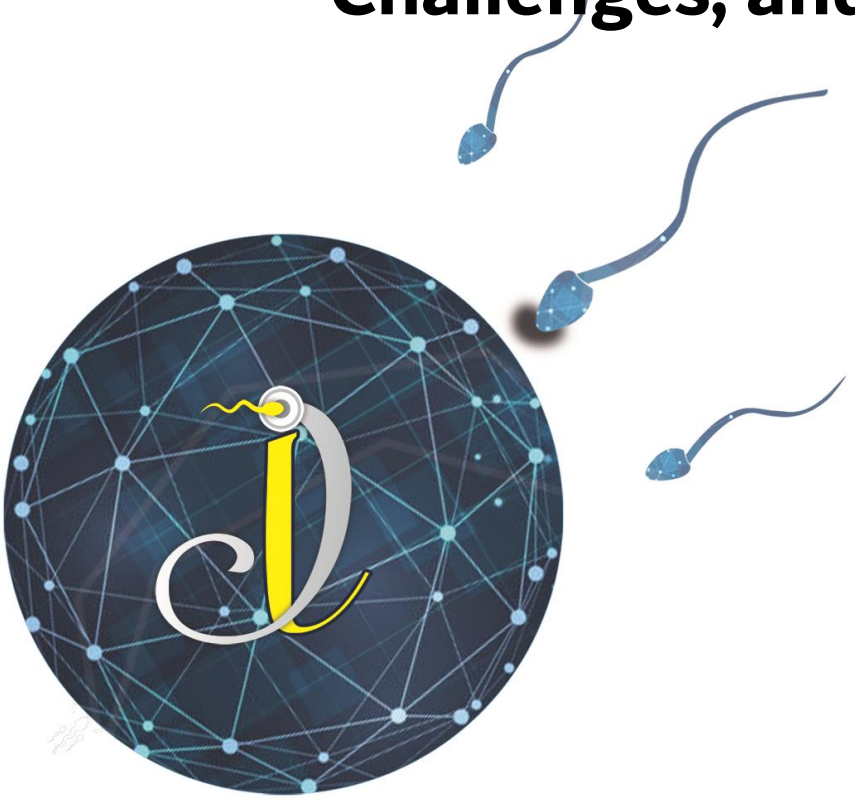
In the Name of God

Insights into Infertility Management Artificial Intelligence (AI) Challenges, and Prospects



Avicenna Research Institute, ACECR

Tehran-Iran

11-13 December 2024

Contents

The authors will bear full responsibility for the accuracy of their English abstracts

Message from the Congress Chair

The most significant phenomenon of the century thus far is the development and colossal growth of artificial intelligence (AI) and its various offshoots. Reproductive technologies and treatment procedures are the arena in which AI has tremendous impacts and although the field is still in its infancy, we will definitely witness the profound evolutionary effect of AI in the realm of infertility management in near future.

As God bestowed the power upon our team to hold the forthcoming congress, we are once again proud to host honorable scientists and researchers in the "Insights into Infertility Management: Artificial Intelligence (AI), Challenges, and Prospects" congress which will be held from December 11-13, 2024, with the cooperation of highly capable scientific and executive teams. In this international congress, we intend to bring together prominent experts in the fields of AI, machine learning, obstetrics, urology, embryology, and bioethics to discuss and exchange thoughtful ideas on how artificial intelligence can revolutionize the diagnosis and treatment of infertility.

The congress will focus on addressing important and practical topics, including AI-based predictive models in IVF success, applications of machine learning methods in embryo selection, automatic analysis of sperm and egg quality, ethical considerations in AI-based reproductive technologies, and the future of personalized treatment plans. Our team members will definitely avail their maximum energy to provide a dynamic, interactive, amicable environment to set the stage for a fruitful landmark event with the presence of renowned experts and researchers of Iran and the world. We hold the participation of researchers, physicians, AI and machine learning experts and students in high regards, and invite you to join us in this great event.

The holding of this international congress will behoove the status of Iran in science and technology realm, and that will be possible only with your companionship and participation. The capable colleagues of Avicenna Research Institute in the scientific and executive committees of this congress eagerly welcome the cooperation of all researchers and specialists, as well as all scientific, research, technological, and industrial centers and institutions that are willing to contribute to the success of this groundbreaking international event.

As the chair of the congress, and on behalf of the scientific and executive secretariat of the congress, I am eagerly waiting for your ideas, suggestions, and cooperation in organizing this magnificent, impactful, and privileged event so that we can start a new chapter in the development of AI application in the treatment of infertility and the relevant ethical considerations.

Dr. Mohammad Reza Sadeghi
Congress Chair

Message from the Scientific Secretariat

The congress on "Insights into Infertility Management: Artificial Intelligence (AI), Challenges, and Prospects" will be held from December 11-13, 2024. The impetus to organize the congress stems from developments and evolutionary transformations in the methods of fertility treatment as well as the growth of AI and its various application in this domain. Therefore, the exchange of new findings between the stakeholders and the scientists of the field is a pressing requirement of the world. To address the challenge, we have planned to invite leading experts of infertility and AI to discuss on the various aspects of AI and its potential applications in infertility treatment procedures. Such intersections between the two above mentioned fields have already been observed in developed countries and we anticipate the emergence of the new technology in the forthcoming future.

Moreover, in tandem with familiarizing the attendees with new techniques of using AI in treatment, we will further our goals by introducing and inviting international guests and speakers to deliver their experiences and insights. Lastly, I would like to express my deepest gratitude to the board of directors at ARI and all the dedicated scientific and executive team members whose unstoppable diligence would truly amalgamate the magnificence and informativeness of the event.

Dr. Soheila Arefi

Scientific Secretariat (Infertility Treatment)

Message from the Scientific Secretariat

I warmly welcome you to the congress on "Insights into Infertility Management: Artificial Intelligence (AI), Challenges, and Prospects". The congress creates unprecedented opportunity for gathering of scientists, researchers, and specialist in various fields of medicine and computer science to exchange their knowledge, experiences, and expertise. As a result, we hope to unveil new horizons in infertility treatments via the innovative application of AI.

AI has culminated in evolutionary transformations in medicine and forged the potentials in diagnosis, prognosis, and treatment of diverse diseases. In the realm of infertility treatment, the technology would improve the therapeutical procedures, enhance the accuracy of treatment, and deliver better prognosis of treatment outcomes. Accordingly, the odds of fecundity of infertile couples would be elevated.

The ultimate objective of the congress is introduction of breakthroughs and relevant research to provide a forum for interaction between researchers and specialists. We deeply hope that the event would build a new road for research and application of AI in infertility treatment, leading to significant advancements. Lastly, I wholeheartedly appreciate the cooperation of all speakers, researchers, and participants whose contributions would definitely garner the scientific takeaway of the event. Moreover, my sincere gratitude goes to all members of the executive team and employees who pave the way for organizing such colossal event. We are hopeful to improve the society health and childbearing prospects among infertile couples with your participation and idea-sharing.

Dr. Hamid Beigi

Scientific Secretariat (Computer Science and AI)

Message from the Executive Secretariat

Under the auspicious endowment of almighty God, Avicenna Research Institute (ARI) as one of the pioneers in proposing and application of cutting-edge scientific advancements in the realm of knowledge and research, plans to establish an international event in a new and applicable field of study.

AI is an emerging phenomenon in all fields, thereby the field of new reproductive technologies will be touched by the evolutions and developments of AI in the near future. Cognizant of these advancements, Avicenna Research Institute and Avicenna Fertility Center have decided to organize and hold the congress on "Insights into Infertility Management: Artificial Intelligence (AI), Challenges, and Prospects" from December 11-13, 2024 with the participation of renowned specialists and scientists.

As the executive secretariat of the congress, I am honored to welcome the attendance of leading scientists, brilliant specialists, all stakeholders, researchers, students, and enthusiasts in AI, medicine, and assisted reproductive technologies, with the companionship of our esteemed executive team members. We hope to surpass the standards of scientific event organization, to bring pride to Iran, and set an environment with camaraderie, hectic interaction, and proliferation. In this regard, we incessantly welcome precious insights and invaluable collaboration from esteemed academic faculties, research institutions, educational centers, and therapeutic facilities and all researchers and creative, enthusiastic students.

Indeed, we do believe that your constructive feedback, supports of organizations, institutions, and companies involved in the field would augment the magnificence and outstanding success of the event. Therefore, our congress secretariat awaits your ideas and perspectives.

Safoora Soleimani Fakhr

Executive Secretariat

Dr. Mohammad Reza Sadeghi

Congress Chair

Dr. Soheila Arefi

Scientific Secretariat

(Infertility Treatment)

Dr. Atousa Karimi

Festival Secretariat

Dr. Hamid Beigi

Scientific Secretariat

(Computer Science and AI)

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Omid Zarei Torkani
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Naeemeh Zolfaghar

Scientific Committee

Dr. Andrew Thomson

Andrew is a highly experienced multi-site IVF Laboratory Director and HFEA Person Responsible at Avenues Centre for Reproductive Health, the first clinic in the world to use a fully end-to-end AI-driven digital infrastructure that captures the most comprehensive fertility journey dataset. He has adopted a quality management heavy, evidence-based approach to ART and is passionate about patient access to care. He has presented his research both nationally and internationally on multiple occasions and is a frequently invited speaker on a wide variety of topics across the IVF and AI spectrum. He was just the third person to be awarded Fellowship of the Royal College of Pathologists (FRCPath) and Fellowship of the Academy for Healthcare Science (FAHCS). He is actively involved in training reproductive scientists to the highest standards and was awarded associate status of the National School of Healthcare Science due to his contributions as a training officer as well as accrediting multiple laboratories to be approved training centers. In 2020, he was awarded the Claire Gillott prize by the Association of Reproductive and Clinical Scientists for outstanding contribution.

Dr. Majid Ebrahimi Warkiani

Dr. Majid Ebrahimi Warkiani is a Professor in the School of Biomedical Engineering at UTS, Sydney, Australia. He earned his PhD in Mechanical Engineering from Nanyang Technological University (NTU, Singapore) under the prestigious SINGA scholarship from A*STAR and completed his postdoctoral training at Massachusetts Institute of Technology (MIT, USA). Throughout his career, he has held fellowships from NRF (2012-2014), NHMRC (2018-2022) and Cancer Institute NSW (2022-2025). Dr. Warkiani has also served as lead and co-investigator on multiple national and international grants, totaling over $12 million in funding. His outstanding research contributions have earned him several awards, including the Young Tall Poppy Science Award (2019), MIT Technology Review-Innovators under 35 Award (2016), and the Nanyang Young Alumni Award (2017). Since 2010, he has published 200 peer-reviewed scientific articles and book chapters in premier journals such as Nature Protocols, Nature Communications, Nature Reviews Urology, Advanced Materials, Trends in Biotechnology, ACS Nano, and Lab on a Chip. Dr. Warkiani is not only a prominent researcher but also a valued member of various biotech companies' advisory boards. Additionally, he actively contributes to the academic community by serving as a guest editor and reviewer for esteemed journals such as Scientific Reports, Nature Biomedical Engineering, Lab on a Chip, and Micromachines.

Dr. Reza Nosrati

Dr. Reza Nosrati is a lecturer in the Department of Mechanical and Aerospace Engineering at Monash University. Prior to joining Monash University, he was an NSERC postdoctoral fellow in the Department of Chemical Engineering at Queen's University (2016-2018). Dr. Nosrati received his Ph.D. in Mechanical Engineering from the University of Toronto (2016), his M.Sc. in Mechanical Engineering from the University of Tehran (2010), and his B.Sc. in Mechanical Engineering from Amirkabir University of Technology (2007). Dr. Nosrati's research focuses on small-scale fluid mechanics (microfluidics and nanofluidics), with applications in cell biology, translational medicine, chemistry, and environmental science. He is a pioneer in microfluidics for male fertility and assisted reproduction. He has authored papers in top-tier scientific journals like Nature Communications, Nature Reviews Urology, Clinical Chemistry, and Lab on a Chip. His work has been highlighted several times in renowned journals such as Nature Reviews Urology, and featured routinely in news sources worldwide, including LA Times, Daily Mail, and The Scientist. Dr. Nosrati has received numerous prestigious awards and recognitions, including an NSERC Postdoctoral Fellowship, a Research Discovery Award from the University of Toronto, the 2016 Douglas R. Colton Medal for research excellence in Microsystems and Nanotechnology in Canada, and the 2018 ROYAN International Research Award for outstanding contributions to Embryology and Andrology.

Dr. Camran Nezhat

Dr. Camran Nezhat has been called the father of modern-day surgery for inventing and pioneering video-assisted endoscopic surgery, which to this day, continues to replace old techniques of open surgery. His developments have revolutionized surgery and gradually replaced laparotomy. He and his team were the first to perform many of the most advanced laparoscopic surgical procedures with and without robotic-arm assistance. Early on he advocated and proved that the majority of the open procedures of the time could be performed via video-laparoscopy. By doing so, he opened the door for surgeons all over the world to advance the field of minimally invasive surgery and help their patients. In the 1990s, he collaborated with robotic pioneers, Ajit Shah and Phil Green, on development of the daVinci Robot and has innovated many of its applications.

Dr. Giles Palmer

Dr. Giles Palmer is a senior clinical embryologist, skilled in laboratory, business and quality management. After graduating in Genetics at Leeds University, UK, he attained a position as research officer at London's Hammersmith Hospital's acclaimed IVF unit working with Professors Lord Winston and Alan Handyside. After a consultancy position for Iceland's first IVF Unit (University Hospital, Reykjavik), he moved to Greece in 1992. Since moving to Greece, he has worked in the largest IVF units in Athens. He was director of the highly successful Assisted Reproduction Unit at Mitera hospital in Athens 2002-2016. His collaboration with St. Sophia's Children's Hospital (Athens University) resulted in the first birth in Greece following embryo-biopsy and pre-implantation genetic diagnosis, and has led to publications in Leading Scientific journals concerning many topics including pre-implantation genetic diagnosis for cystic fibrosis and beta-thalassaemia. He is a member of ESHRE (European Society of Human Reproduction and Embryology), ARCS (The Association of Reproductive and Clinical Scientists), PEKE (Greek Society of Clinical Embryologists), SLTB (Society of Low Temperature Biology) and has been accredited with Senior Embryologist Status by ESHRE. More recently, he has become a consultant and product developer in a wide range of areas within the industry including cleanroom technology; quality management, risk assessment for clinics and cryo-storage facilities and artificial intelligence in ART.

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Chairman of Avicenna Research Institute

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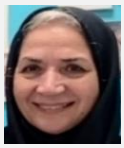

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Specialist in Graph Neural Networks for Biomedical Applications, Reinforcement Learning, and Affective Computing

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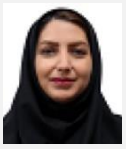

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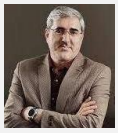

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Panberes

لطافت بی‌نظیر برای پوست‌های حساس (نوار بهداشتی‌های لطیف)

۱- لطیف ضخیم خیلی خیلی بزرگ

مناسب برای خونریزی خیلی زیاد _لایه رویی: نانوون (نرم و لطیف)_تعداد قطره: ٦

۲- لطیف ضخیم بزرگ

مناسب برای خونریزی زیاد_لایه رویی: نانوون (نرم و لطیف)_تعداد قطره: ٦

۳- لطیف نازک بزرگ

مناسب برای خونریزی زیاد_لایه رویی: نانوون (نرم و لطیف) _تعداد قطره: ٥

محافظت کامل برای روزهای پرتحرک (نوار بهداشتی‌های روزانه)

۱-روزانه ضخیم خیلی خیلی بزرگ

مناسب برای خونریزی خیلی زیاد _لایه رویی: مشبک_تعداد قطره: ٦

۲-روزانه ضخیم بزرگ

مناسب برای خونریزی زیاد_لایه رویی: مشبک_تعداد قطره: ٦

۳-روزانه نازک بزرگ

مناسب برای خونریزی زیاد _لایه رویی: مشبک_تعداد قطره: ٥

آرامش شبانه با حس راحتی و اطمینان (نوار بهداشتی‌های شبانه)

۱-شبانه ضخیم خیلی خیلی بزرگ

مناسب برای خونریزی خیلی زیاد_لایه رویی: مشبک ویژه_تعداد قطره: ٦

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راحتی، سبکی و اطمینان در هر لحظه از روز

۱-دایموند بزرگ لطیف ۲- دایموند خیلی خیلی بزرگ لطیف

مناسب برای پوست های حساس_تعداد قطره: ۷

لایه رویی: نانوون (نرم و لطیف) _استفاده شده از لایه ایرلید

قدرت جذب: فوق العاده (در مقایسه با نوارهای بهداشتی از جنس ایرلید)

۳-دایموند بزرگ شبانه ٤-دایموند خیلی خیلی بزرگ شبانه

مناسب برای پوست های حساس_تعداد قطره: ۷

لایه رویی: مشبک ویژه_استفاده شده از لایه ایرلید

قدرت جذب: فوق العاده (در مقایسه با نوارهای بهداشتی از جنس ایرلید)

حس راحتی و پاکیزگی در طول روز (پد روزانه)

۱- پد کیسه ای بزرگ ۲-پد کیسه ای متوسط ۳-پد جعبه ای بزرگ ٤-پد جعبه ای متوسط

پدهای روزانه پنبه ریز برای استفاده‌ی روزمره، در حین سفر و برای کسانی که لکه‌بینی دارند مناسب‌اند. این محصولات جهت جذب ترشحات و مقابله با عفونت و آلودگی طراحی شده‌اند. به دلیل لایه رویی پنبه ای، لطیف و ضد حساسیت هستند. **پدهای روزانه جایگزین نوار بهداشتی نیستند و باید هر ۲ تا ۳ ساعت یک‌بار تعویض شوند.** این پدها در سایزهای بزرگ و متوسط و دو نوع کیسه‌ای و جعبه‌ای در دسترس هستند.

Panberes

پنبه‌ریز با بیش از سه دهه تجربه در تولید محصولات بهداشتی، همواره در زمینه تأمین سلامت و آسایش زنان و دختران ایرانی پیشگام بوده است. این برند با ارائه محصولاتی متنوع مانند نوار بهداشتی، پد روزانه، چسب زخم و گوش پاک‌کن، تلاش دارد تا نیازهای بهداشتی جامعه را به بهترین شکل ممکن برآورده کند.

ژل بهداشتی بانوان

در ادامه تعهد همیشگی پنبه‌ریز به سلامت و آسایش زنان، ژل بهداشتی بانوان پنبه‌ریز به‌عنوان محصول جدید و نوآورانه این برند معرفی شده است تا با ویژگی‌های منحصربه‌فرد، تجربه‌ای تازه در ارتقاء بهداشت شخصی را به ارمغان آورد.

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- ایجاد شادابی و کنترل بوی نامطبوع
- حفظ نرمی و رطوبت ناحیه تناسلی
- پیشگیری از سوزش و خارش
- خاصیت ضدالتهابی برای کاهش تحریکات پوستی
- ایجاد حس خنکی، تازگی و طراوت
- فاقد SLS، SLES، پارابن، الکل و صابون

ژل بهداشتی بانوان پنبه‌ریز با ترکیبات طبیعی، ملایم و تقویت‌کننده، در دو فرمولاسیون ویژه برای پوست‌های حساس و نرمال طراحی شده است تا سلامت و لطافت را به بهترین شکل ممکن حفظ کند

هر روزه

ژل بهداشتی بانوان

حاوی پری بیوتیک

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Avicenna Research Institute
Iranian Academic Center for Education Culture and Research (ACECR)

Keynote Lecturers

Day 1 (December 11, 2024) Abu Reihan Hall		
AI for Male Fertility	Dr. Reza Nosrati	Australia
Genetics and AI	Dr. Saeed Reza Ghaffari	Iran
Day 2 (December 12, 2024) Abu Reihan Hall		
The Value of Risk Prediction Models Based on Machine Learning for Predicting Recurrent Pregnancy Loss	Dr. Amir Hassan Zarnani	Iran
The Role of Artificial Intelligence in Drug Discovery and Development	Dr. Hassan Homayoun	Iran
The Success of IVF	Dr. Abbas Aflatoonian	Iran
Day 3 (December 13, 2024) Abu Reihan Hall		
Bringing the IVF Lab into the Digital Age	Dr. Andrew Thomson	UK
Adenomyosis Guidelines and the Role of AI in Guideline Design	Saeed Alborzi	Iran

Congress Program

Day 1 (December 11, 2024)

Panel Chair	Panel Title	Panel Members	Venue	Time
Dr. Alireza Heidarnejad	The Role of AI in Optimizing Egg, Sperm, and Embryo Selection in Assisted Reproductive Technology (ART)	Dr. Majid Ebrahimi Warkiani (Australia) AI-enabled Microfluidic Technologies for ART Dr. Mohammad Hossein Nasr Esfahani, Dr. Davood Fathi, Dr. Mohammad Reza Sadeghi, Dr. Mina Vardiani, Dr. Nima Narimani	Abu Reihan Hall	08:00-9:30
Dr. Sedigheh Hantoushzadeh	The Role of AI in Ensuring Healthy Births	Dr. Soudabeh Kazemi, Dr. Marjan Ghaemi, Dr. Hamid Mokhtari	Allameh Tabatabai Hall	08:00-9:30
Keynote Lecture	AI for Male Fertility by Dr. Reza Nosrati (Australia)		Abu Reihan Hall	09:30-10:00
	Opening Ceremony			10:00-11:00
	Break			11:00-12:00
Dr. Ashraf Alyasin	The Role of AI in Predicting IVF Treatment Outcomes for Unexplained Infertility	Dr. Fatemeh Ghalambor, Dr. Aida Najafian, Dr. Firouzeh Ghaffari, Dr. Marzieh Ghasemi, Dr. Hossein Ahmadvand	Abu Reihan Hall	12:00-13:30
Dr. Hamid Beigi	Chatbot, the Way to Increase Fertility Awareness	Dr. Mahmoud Tara, Dr. Soheila Ansaripour, Dr. Reza Rabiei	Allameh Tabatabai Hall	12:00-13:30
	Lunch Break			13:30-15:00
Keynote Lecture	Genetics and AI by Dr. Saeed Reza Ghaffari		Abu Reihan Hall	15:00-15:30
Dr. Saeed Reza Ghaffari	Genetic Diseases: The Role of AI in Prediction, Diagnosis, and Promoting Healthy Pregnancies	Dr. Fereshteh Maryami, Dr. Damoun Nashtaali, Dr. Mahdieh Soleymani	Abu Reihan Hall	15:30-17:00
Dr. Zeinab Barzegar	Data Preparation, Aggregation, and Transformation in AI Applications	Dr. Habibollah Asghari Dr. Ali Sadeghitabar, Dr. Ali Akbar Kiaei	Allameh Tabatabai Hall	15:30-17:00

Congress Program

Day 2 (December 12, 2024)

Panel Chair	Panel Title	Panel Members	Venue	Time
Keynote Lecture	The Value of Risk Prediction Models Based on Machine Learning for Predicting Recurrent Pregnancy Loss by Dr. Amir Hassan Zarnani		Abu Reihan Hall	08:00-08:30
Dr. Ashraf Moeini	Recurrent Miscarriage, Diagnosis, and Treatment Using AI	Dr. Amir Hossein Zarnani, Dr. Ladan Kashani, Dr. Maryam Moshfeghi, Dr. Navid Almadani, Dr. Maedeh Tahaei	Abu Reihan Hall	08:30-10:00
Dr. Arash Mohazzab	The Role of AI in Research	Dr. Zeinab Barzegar, Dr. Amir Hossein Shirazi, Zohreh Fazli	Allameh Tabatabai Hall	08:30-10:00
Break				10:00-11:00
Keynote Lecture	The Role of Artificial Intelligence in Drug Discovery and Development by Dr. Hassan Homayoun		Abu Reihan Hall	11:00-11:30
Dr. Zahra Heidar	The Role of AI in Personalizing Ovarian Stimulation Protocols	Dr. Fatemeh Forouzanfard, Dr. Nezhat Mousavifar, Dr. Azadeh Akbari, Dr. Hamid Mokhtari, Dr. Marzieh Farimani	Abu Reihan Hall	11:30-13:00
Dr. Saeed Arasteh	The Role of AI in Management of Male Factor Infertility	Dr. Naser Amir Jannati, Dr. Fatemeh Kheirkhah, Dr. Alireza Chamani Tabriz, Dr. Shadi Oyarhossein	Allameh Tabatabai Hall	11:30-13:00
Lunch Break				13:00-14:00
Keynote Lecture	The Success of IVF by Dr. Abbas Aflatoonian		Abu Reihan Hall	14:00-14:30
Dr. Robabeh Taheripanah	The Role of AI in Predicting IVF Success	Dr. Mohammad Ebrahim Parsanejad, Dr. Abbas Aflatoonian, Dr. Marefat Ghaffari Novin, Dr. Maedeh Tahaei	Abu Reihan Hall	14:30-16:00
Dr. Mohammad Rasekh	Ethics of AI and ARTs	Dr. Alireza Milanifar, Dr. Fereshteh Azedi, Dr. Behzad Ghorbani, Faezeh Ameri	Allameh Tabatabai Hall	14:30-16:00

Congress Program

Day 3 (December 13, 2024)

Panel Chair	Panel Title	Panel Members	Venue	Time
Keynote Lecture	Bringing the IVF Lab into the Digital Age by Dr. Andrew Thomson (UK)		Abu Reihan Hall	08:00-08:30
Dr. Saghar Salehpour	The Role of AI in PCOS Prognosis, Diagnosis, and Medical Treatment Algorithms	Dr. Atousa Karimi, Dr. Mahsa Kazemi, Dr. Sedigeh Hosseini, Dr. Mohammad Reza Sadeghi, Dr. Ali Ali Akbarlu	Abu Reihan Hall	08:30-10:00
	Break			10:00-10:15
Dr. Abolfazl Mehdizadeh	Laparoscopy, Robotic Surgery, and AI Application	Dr. Camran Nezhat (USA): How Artificial Intelligence, Virtual Reality, and Robotics Technologies Are Changing the Practice of Medicine and Surgery Dr. Hassan Homayoun, Dr. Shahla Chaichian, Dr. Alireza Mirbagheri	Abu Reihan Hall	10:15-11:45
Keynote Lecture	Adenomyosis Guidelines and the Role of AI in Guideline Design by Saeed Alborzi		Abu Reihan Hall	11:45-12:15
Dr. Saeed Alborzi	The Role of AI in Predicting and Guiding the Diagnosis and Treatment Algorithms for Endometriosis	Dr. Ziba Zahiri, Dr. Tahereh Pourdast, Dr. Elham Askari, Dr. Mehrzad Lotfi, Dr. Khadijeh Shadjoo, Dr. Roya Padmehr	Abu Reihan Hall	12:15-13:45
	Closing Ceremony 13:45-14:45			

Abstracts

AI for Sperm Selection and Analysis in ART

Reza Nosrati
Applied Microfluidics and Bioengineering (AMB) Lab, Department of Mechanical and Aerospace Engineering, Monash University, Melbourne, Australia

Abstract

Artificial intelligence (AI) has revolutionized the field of assisted reproductive technologies (ART) by enhancing the accuracy and efficiency of sperm analysis and selection. By integrating AI with advanced imaging and microfluidic techniques, my group has developed sophisticated models for real-time, high-throughput assessment of sperm quality. These AI-driven models leverage machine learning algorithms to analyze sperm motility patterns, morphology, and physiological responses, providing a comprehensive evaluation that closely mirrors the natural selection processes occurring within the female reproductive tract. This talk will delve into the cutting-edge AI methodologies developed for sperm selection in ART, highlighting how these technologies improve the precision of sperm quality assessment to increase the success rates of fertilization.

Keywords: Assisted reproductive technologies, Machine learning, Microfluidic techniques, Sperm quality, Sperm selection

Bringing the IVF Laboratory into the Digital Age

Andrew Thomson
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University College London (UCL), London, UK

Abstract

The complexity and time requirements for contemporary ART laboratory activities has increased compared with traditional IVF cycle requirements from roughly 9 personnel hours, to 20 hours for completion (ASRM, 2022). Assisted reproductive technology (ART) laboratories have previously been encouraged to consider laboratory assistants to support their embryologists in completing tasks that are important and time-consuming but do not require specific training including paperwork completion, documentation scanning, and embryo shipments to and from other laboratories. However, this approach is still labor intensive, prone to human error, and costly. An alternative may be to automate these processes. Integrations between multiple Apps into the Embie app increased clinic productivity. On average, it reduced clinician time by one hour, nursing time 2.5 hours, and two hours of embryology time per cycle. This was achieved in the laboratory via expansion of the RI Witness system to capture laboratory data at the source. For example, number of eggs collected was directly recorded by RI and then pushed directly into the Embie in real time. This changed the pathway from data entry to data verification. Fertilization, embryo development, and utilization were pushed directly from CHLOE into Embie, further removing data entry. This also minimized data entry errors. Additional integrations between CHLOE and Embie allowed patients to view their embryos in real time and minimized phone calls to the laboratory from patients, reducing interruptions and embryology workload. Survey of staff, pre- and post- integrations, revealed all staff felt they had better work/life balance, reduced stress levels, and more time to spend on laboratory procedures when using these integrations.

Keywords: Assisted reproductive technologies, CHLOE, Digital age, Embie app, IVF laboratory

Bioengineering and Artificial Intelligence in ART: No Longer Science Fiction?

Majid Ebrahimi Warkiani
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Abstract

Microfluidics and artificial intelligence (AI) are emerging as disruptive technologies across various fields, and they are now making significant impacts in Assisted Reproductive Technology (ART). Microfluidics, characterized by the engineered manipulation of fluids at the microscale, offers precise control over the cellular microenvironment. This precision is invaluable in reproductive medicine, enabling enhanced understanding and manipulation of sperm cells. When combined with AI—which excels at processing and analyzing complex data patterns—these technologies provide powerful tools for improving outcomes in in vitro fertilization (IVF). The miniaturization inherent in microfluidic systems allows for massive parallel processing, making them exceptionally suited for high-throughput biological experiments. Over the past decade, my group has developed microfluidic platforms for cell sorting, translating them into clinical applications. We've improved sperm sorting techniques for better selection of viable sperm, enhancing IVF success rates and advancing diagnostics in andrology. In this seminar, I will showcase our contributions, demonstrating how microfluidics and AI are revolutionizing ART with innovative solutions in sperm analysis and beyond.

Keywords: Artificial intelligence, Assisted reproductive technology, In vitro fertilization, Microfluidics, Reproductive medicine

The Use of Chatbots in Medicine

Soheila Ansaripour
Avicenna Fertility Center, Avicenna Research Institute, ACECR, Tehran, Iran

Abstract

The use of chatbots in medicine, particularly in the field of infertility, is emerging as a transformative tool that offers both significant benefits and important limitations. On the positive side, chatbots can provide patients with 24/7 access to information, allowing them to seek answers to fertility-related questions at any time. This constant availability can reduce anxiety for patients undergoing treatment, who often face emotional stress and uncertainty. Chatbots can also streamline administrative tasks like appointment scheduling, sending reminders for medication, and even answering insurance-related questions, reducing the workload for clinic staff and freeing up time for doctors to focus on patient care.

Another critical advantage is that chatbots can help improve patient education by offering accurate, standardized information about fertility treatments, such as IVF, IUI, or egg freezing. For instance, they can guide patients through common questions about the process, success rates, and possible side effects, reducing misinformation and helping patients make informed decisions. Furthermore, chatbots can act as a preliminary triage tool, asking patients about their symptoms and treatment history before they speak with a fertility specialist, which can optimize consultation time and allow doctors to focus on more complex cases.

However, the limitations of chatbots are significant and cannot be overlooked. A chatbot lacks the emotional intelligence and empathy required to support patients during what is often a highly emotional and personal journey. Infertility is a deeply sensitive topic that involves not just physical health but also psychological and emotional well-being. While chatbots can provide factual information, they cannot offer the emotional support and reassurance that many patients seek from their doctors. Additionally, while chatbots can handle routine questions, they are not equipped to diagnose conditions, interpret complex medical results, or recommend personalized treatment plans based on a patient's unique health profile.

Privacy and data security are also critical concerns when implementing chatbots in healthcare. Chatbots collect vast amounts of personal health information, and any breach in data security could result in serious consequences for patients. It is essential for healthcare organizations to ensure that chatbot systems comply with strict data protection regulations to maintain patient confidentiality and trust.

Looking toward the future, advancements in artificial intelligence (AI) and machine learning could allow chatbots to become more intuitive and personalized. With the integration of AI, future chatbots could analyze individual health data—such as hormone levels, genetic information, or past treatment responses—to offer more tailored advice. This could help fertility specialists design more effective, customized treatment plans

for patients. For instance, AI-powered chatbots could help predict the likelihood of success for certain treatments based on real-time data, offering patients more personalized prognosis. Additionally, chatbots could assist with monitoring ongoing treatments, reminding patients to take medications or prompting them to report side effects, which can enhance treatment adherence and early intervention in case of complications. Moreover, chatbots could play a vital role in global health, particularly in areas where access to fertility specialists is limited. In low-resource settings, where infertility treatments may not be easily accessible, chatbots could provide preliminary guidance and information, helping to bridge the gap between patients and fertility care. This could be especially useful in countries with a shortage of reproductive endocrinologists or fertility specialists.

However, despite these promising advancements, it is important to remember that chatbots should complement, not replace, human healthcare providers. The collaboration between AI-powered chatbots and healthcare professionals could lead to improved patient outcomes, but human oversight will always be necessary to ensure accuracy, empathy, and the ethical delivery of care. Chatbots will need continuous updates and rigorous testing to keep up with medical advancements, as outdated or incorrect information could pose significant risks to patients.

In summary, while chatbots in the field of fertility medication hold great potential to enhance patient engagement, improve access to care, and streamline clinical processes, they must be carefully integrated into the healthcare system. Their future success will depend on addressing limitations such as empathy, data privacy, and the need for personalized, nuanced medical care. As technology continues to evolve, chatbots may increasingly serve as valuable tools in fertility treatment, but they will always require human collaboration to provide the best patient-centered care.

Keywords: Artificial intelligence, Chatbots, Healthcare system, Infertility treatment, Machine learning, Personalized treatment

Surplus Data and Privacy: A Point on the Ethics of Use of AI in ARTs

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Abstract

AI has shown another wave of staggering progress in science and technology in human life. This wave has inevitably entered the field of ARTs and, hence, despite the fact that it can make fertility and reproduction in this field more efficient, successful, and closer to personalized needs, it has given rise to certain ethical problems and questions. That is, AI, in this realm, can endanger privacy, consent and data security, and also lead to discrimination and social inequalities.

In this research, the focus is on the impact of using AI in the field of ARTs on privacy. However, it should be noted that the discussion of privacy is inevitably related to other ethical issues in this field, such as full informed consent, ownership of data, and supervision of AI models. In the first place, since a huge amount of sensitive genetic data and medical records are stored in this application, there is a risk of intentional and unintentional disclosure, unauthorized access, and extensive hacking of these data by natural or legal persons for various material and non-material purposes. Secondly, unawareness of patients and subjects of the method of collecting, analyzing, and maintaining their data can lead to the lack of fully informed consent. In other words, they may consent to an action that is apparently acceptable, but in complex relationships and communications, it might end up with the transfer of the data to parties that the consenter does not agree with. Thirdly, even anonymized data may lead to the re-identification of the data owner, especially gamete donors, due to the capabilities of AI to perform frequent cross-references. Fourthly, AI can be used to predict genetic characteristics of the embryo and endanger its privacy in future. Finally, long-term storage of data can affect the privacy of the patient's offspring and future generations.

The aforementioned risks, in fact, lay bare the formation of surplus data and various risks it bears for privacy. This problem, in turn, can cause other ethical issues, i.e. lack of fully informed consent, cultural changes, emergence of eugenic models, and exacerbation of unjustified inequalities. Therefore, one of the most important and urgent needs in this field is to take necessary and appropriate measures for “transparent transfer” and “protection” of data, on the one hand, and strict “monitoring” of all AI applications in ARTs and reproduction.

Keywords: AI, ARTs, Monitoring, Privacy, Protection, Surplus data, Transparency

The Role of Artificial Intelligence in Enhancing Infertility Treatments

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Abstract

Infertility is a common reproductive health problem that affects millions of people around the world. Artificial intelligence (AI) is a science and engineering discipline that combines reasoning, learning, insight, problem solving, and language understanding and is bringing new changes and developments in treatment. In vitro fertilization (IVF) is one of the most common methods of treating infertility, and one of its main challenges is the evaluation and selection of embryos for implantation. Computer-Assisted Semen Analysis (CASA) system utilizes convolutional neural network (CNN) with artificial intelligence-based approach to analyze flagellar waveforms and sperm movement propagation. Additionally, it evaluates sperm movements and identifies differences in movement pattern along their path and area traveled. However, the main question is how this movement is related to its metabolic regulation. Artificial intelligence can be utilized to identify sperm that cover a distance of less than 40 micrometers per second, indicating metabolic disturbances. These sperm produce less ATP, which may contribute to the possibility of unfertilized eggs in women. Other common causes of infertility, such as endometriosis and polycystic ovary syndrome (PCOS), can also be effectively diagnosed using AI. The role of artificial intelligence in embryo analysis is also of great importance. Considering the increasing growth of infertility and the role of artificial intelligence in various sciences including medicine, its application in assisted reproductive technologies such as selecting sperms with optimal motility and transferring high-quality embryos in the IVF procedure increases the success rates and contributes to effective infertility treatment.

Keywords: Artificial intelligence, Assisted reproductive technology, Embryo analysis, Infertility treatment

The Role of AI in the Diagnosis of Cervical Dysplasia

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Abstract

Cervical dysplasia, a precursor to cervical cancer, is traditionally diagnosed through screening methods such as Pap smears, colposcopy, and biopsy. However, these methods are often limited by human error, interobserver variability, and accessibility challenges, particularly in resource-limited settings. Artificial Intelligence (AI) offers significant potential to enhance diagnostic accuracy and efficiency by automating the analysis of medical images and cytology slides.

This presentation explores the application of AI in the diagnosis of cervical dysplasia, including its role in improving the accuracy of Pap smear interpretations and colposcopy-guided biopsy decisions. AI-powered tools have shown promise in reducing false positives and negatives, providing faster results, and extending diagnostic capabilities to underserved areas. Despite its benefits, the integration of AI into clinical practice must navigate challenges such as data privacy, algorithm bias, and the need for seamless adoption into existing workflows. As AI continues to advance, it stands poised to revolutionize gynecological diagnostics, enabling earlier detection and better patient outcomes.

Keywords: Artificial intelligence, Cervical dysplasia, Cervical cancer, Diagnostic accuracy, Diagnostics

Artificial Intelligence in Personalized Infertility Treatment: A Novel Approach to Targeted Diagnosis

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Abstract

Background: Infertility affects millions of couples worldwide, with various causes that require individualized treatment plans. Traditional diagnostic methods, while effective, often fail to account for the complexity and uniqueness of each patient's reproductive health. Recent advancements in artificial intelligence (AI) have shown promising potential in improving personalized diagnosis and treatment. This study explores the application of AI in enhancing diagnostic precision in infertility treatments by analyzing patient data more effectively.

Methods: A comprehensive literature review and analysis of clinical data were conducted using AI algorithms, including machine learning (ML) and deep learning (DL) techniques. Patient records from multiple infertility clinics were utilized, encompassing demographic data, hormonal profiles, genetic information, and prior treatment outcomes. These AI models were trained to predict infertility causes and suggest personalized treatment pathways based on the unique characteristics of each patient.

Results: The AI-driven models outperformed traditional diagnostic approaches in terms of both accuracy and speed. The predictive models demonstrated an accuracy rate of over 85% in identifying the root causes of infertility, such as hormonal imbalances, genetic factors, and reproductive abnormalities. Furthermore, the AI-based recommendations for treatment showed improved success rates, particularly in predicting the optimal type and timing of interventions like in vitro fertilization (IVF).

Conclusion: AI has the potential to revolutionize personalized infertility treatment by offering more precise diagnostic tools and tailored therapeutic strategies. By integrating AI into clinical practice, healthcare providers can significantly enhance treatment outcomes, reduce time to pregnancy, and offer hope to couples struggling with infertility. Further research and clinical trials are needed to validate these findings on a larger scale and ensure the ethical use of AI in reproductive medicine.

Keywords: Artificial intelligence, Infertility, Personalized treatment, Reproductive medicine

Artificial Intelligence and Genetics of Infertility

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Abstract

Artificial intelligence (AI) is transforming the diagnosis of genetic causes of infertility by improving the speed and accuracy of data analysis. Infertility can result from genetic abnormalities, such as chromosomal disorders or gene mutations affecting sperm or egg quality. Traditional methods of diagnosing genetic infertility are often slow and complex due to the vast amount of genomic data involved. AI, with its advanced algorithms, can quickly analyze large datasets, identifying patterns and mutations that contribute to infertility. AI is particularly useful in processes like whole genome sequencing (WGS) or preimplantation genetic testing (PGT), where it helps identify genetic issues in embryos, such as chromosomal abnormalities, improving IVF success rates. AI also assists in diagnosing genetic causes of both male and female infertility, like Y-chromosome microdeletion in men or conditions like polycystic ovary syndrome (PCOS) in women. AI contributes to both male and female infertility diagnosis, offering insights into genetic conditions affecting sperm quality or ovarian function. It also facilitates personalized fertility treatments by tailoring therapies based on each patient's genetic profile, predicting treatment success, and optimizing outcomes.

Beyond diagnosis, AI contributes to personalized fertility treatments by analyzing genetic and clinical data to recommend optimized therapies for each individual. It can also predict the likelihood of treatment success, offering more tailored approaches to fertility care. AI's ability to examine gene-environment interactions helps to identify how lifestyle or environmental factors affect fertility in those with certain genetic predispositions. However, challenges exist such as data privacy, bias, and ethical concerns, especially regarding embryo selection. Overall, AI is revolutionizing the field of reproductive medicine by enabling faster, more precise diagnoses of genetic infertility and guiding personalized treatments for better outcomes. AI offers significant hope for individuals and couples facing infertility.

Keywords: Artificial intelligence, Infertility, Genetic data, Personalized treatment, Reproductive medicine

Thrombophilia and Recurrent Miscarriage

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Abstract

Inherited thrombophilia, including Factor V Leiden mutation, protein C and S deficiencies, antithrombin deficiency and prothrombin gene mutation, are established causes of systemic thrombosis. However, inherited thrombophilias have also been implicated as a possible cause in recurrent miscarriage and late pregnancy complications with the presumed mechanism being thrombosis of the uteroplacental circulation. Meta-analyses of pooled data suggest that the magnitude of the association between inherited thrombophilias and fetal death varies according to the type of thrombophilia, timing of fetal death, maternal ethnicity, and maternal age. It is generally recognized that there is a stronger and more consistent association between second trimester miscarriages and inherited thrombophilias. To date, the following associations have been shown through systematic reviews and meta-analyses: Factor V Leiden appears to be associated with first and particularly second trimester recurrent miscarriages; prothrombin gene mutation is associated with recurrent miscarriage; protein S deficiency has not demonstrated a consistent association with recurrent first trimester miscarriage, but has shown an association with second trimester; protein C deficiency has not shown a consistent association with recurrent miscarriage; methylenetetrahydrofolatereductase (MTHFR) mutation (heterozygous and homozygous) has been found to have a significant association with recurrent miscarriage in one meta-analysis from China, yet other meta-analyses did not find an association and advise against testing for this mutation; antithrombin deficiency is the rarest yet most thrombogenic mutation. Antiphospholipid syndrome (APS) is defined as the association between antiphospholipid (APL) antibodies (lupus anticoagulant, anticardiolipin [ACL] antibodies and antibeta-2-glycoprotein-I antibodies) and adverse pregnancy outcome or vascular thrombosis. Adverse pregnancy outcomes include three or more consecutive miscarriages before 10 weeks of gestation, one or more morphologically normal fetal deaths after the tenth week of gestation, and one or more preterm births before 34+0 weeks of gestation because of placental disease. Lupus anticoagulant was found to have the strongest association with recurrent miscarriage. IgG and IgM ACL antibodies were found to have the second strongest association with recurrent miscarriage. Antibeta-2-glycoprotein-I antibodies showed a trend towards a positive association, but this did not reach statistical significance, prompting the authors to conduct further studies to clarify the role of antibeta-2-glycoprotein-I antibodies in recurrent miscarriage.

Keywords: Fetal death, Pregnancy complications, Recurrent Miscarriage, Thrombophilia

The Role of AI in Enhancing Oocyte Quality Prediction in IVF Procedures

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Abstract

Embryo/oocyte quality prediction using AI has gained considerable attention in Assisted Reproductive Technology (ART), particularly in IVF (in vitro fertilization). Traditional methods of embryo evaluation rely heavily on morphology and experience-based assessments, which are time-consuming and prone to human error. The emergence of Artificial Intelligence (AI), specifically machine learning and deep learning, offers promising solutions for enhancing embryo selection accuracy and improving IVF outcomes. AI models, such as convolutional neural networks (CNNs), have demonstrated the ability to process large datasets and detect complex, subtle features in time-lapse images that are often imperceptible to the human eye. By analyzing the morpho-kinetics of embryo development, AI can predict developed stages like blastocyst formation and implantation potential with high accuracy. These systems not only improve the precision of oocyte quality assessments but also reduce the subjectivity associated with manual evaluations. Several studies have shown that AI can outperform human embryologists in predicting embryo viability, especially when combined with other clinical and genetic data. This multi-faceted approach integrates static and dynamic imaging data, providing a comprehensive evaluation of embryo quality. The benefits of AI in embryo assessment include increased diagnostic accuracy, reduced costs, and a faster decision-making process, making it a valuable tool in IVF clinics. Despite its potential, challenges remain in the integration of AI into clinical practice. Issues such as data standardization, privacy concerns, and the explainability of AI models must be addressed to ensure widespread adoption. Nevertheless, the continuous advancement of AI technologies holds the potential to revolutionize embryo selection, ultimately improving ART success rates and patient outcomes.

Keywords: AI, Blastocyst, Deep learning, Embryo quality, Embryo selection, IVF, Morpho-kinetics

Ethical Challenges of Neurotechnology and Artificial Intelligence in Enhancing Reproductive Medicine

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Abstract

Today, combining artificial intelligence (AI) and neurotechnology with reproductive medicine shows a great impact in the treatment of infertile couples. The new term “Repro-AI” is defined as the interdisciplinary technology between assisted reproductive technologies (ARTs) and mathematical sciences. The development of several Repro-AI technologies can be seen such as automated time-lapse imaging, single-step culture, integrated digital and laboratory health data, monitoring environmental systems, “laboratory on a chip” (IVF, ICSI, biopsy, and freezing of embryos in fine chambers), and "DIY"(do-it-yourself) IVF cycles. However, based on recent findings, these technologies can easily become a threat to notions of human identity, human dignity, freedom of thought, autonomy, privacy, and well-being. It is well established that ART and reproductive medicine alone present numerous ethical challenges. Therefore, combining these fields with neurotechnologies and AI creates complex conditions and raises many ethical concerns. Neuroethics and AI ethics are defined as a subfield of bioethics that focus on the ethical, legal, and social dimensions of neuroscientific research, particularly addressing the ethical issues arising from developments in neuroscience and AI. When Repro-AI is applied, individual ethics such as avoiding discrimination, respecting autonomy and service ethics such as preventing privacy invasion and reducing harm have to be considered. It is hoped that these reflections will be viewed as an opportunity to continue exploring the different ways in which neuroethics and AI ethics related to ARTs and reproductive medicine can collaborate to ethically shape the future of responsible Repro-AI.

Keywords: AI ethics, Artificial intelligence, Neuroethics, Neurotechnology, Reproductive medicine

The Integration of Artificial Intelligence in Endometriosis Surgery

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Abstract

Endometriosis is a chronic gynecological condition affecting approximately 10% of women of reproductive age worldwide. It is characterized by the growth of endometrial-like tissue outside the uterine cavity, leading to symptoms such as pelvic pain, dysmenorrhea, and infertility. The complexity of endometriosis lies in its heterogeneous presentation and the challenges associated with its diagnosis and treatment. Traditional surgical approaches, primarily laparoscopy, have been foundational in management but are limited by the surgeon's expertise and the disease's intricate nature. The advent of Artificial Intelligence (AI) in medicine offers promising advancements in enhancing the accuracy and efficacy of endometriosis surgery. The diagnosis of endometriosis often involves a significant delay, averaging 7 to 10 years from the onset of symptoms. This delay is attributed to the nonspecific nature of symptoms and the limitations of imaging modalities in detecting deep infiltrating lesions. Surgical intervention aims to excise or ablate endometrial lesions, alleviate symptoms, and improve fertility outcomes. However, the success of surgery is contingent upon the complete removal of lesions, which can be challenging due to their varying locations and appearances. AI, particularly machine learning and deep learning algorithms, has shown the potential in improving the detection of endometriosis through imaging analysis. By training algorithms on large datasets of pelvic ultrasounds and MRI scans, AI can identify patterns and features indicative of endometrial lesions that may be imperceptible to the human eye. This advanced interpretation of imaging can improve both the sensitivity and specificity of various imaging modalities, facilitating early detection of lesions and decreasing the reliance on invasive diagnostic procedures. Furthermore, ongoing research into AI-driven analysis of biomarkers from blood or endometrial tissue samples holds promise for developing less invasive diagnostic techniques, potentially transforming the way endometriosis is diagnosed and managed.

In the surgical realm, AI contributes to preoperative planning and intraoperative decision-making:

3D Reconstruction and Modeling: AI can process imaging data to create detailed 3D models of a patient's pelvic anatomy, allowing surgeons to visualize the exact location and extent of endometrial lesions preoperatively.

Robotic Surgery Integration: AI enhances robotic-assisted surgeries by providing real-time feedback and precision control. Surgeons can perform more meticulous dissections, preserving healthy tissue and reducing complications.

Intraoperative Guidance Systems: AI-powered augmented reality (AR) can project critical information onto the surgeon's visual field, highlighting lesion boundaries and vital structures, thereby enhancing surgical accuracy. AI's ability to analyze vast amounts of data facilitates personalized medicine approaches. machine learning models can predict disease progression and recurrence risks, enabling tailored surgical and medical

management plans (Risk stratification). AI can help anticipate patient responses to surgery, assisting in setting realistic expectations and postoperative care plans (Outcome prediction). AI extends its benefits to postoperative management. First, through digital health platforms, AI-driven apps can monitor patient-reported outcomes, track recovery progress, and identify early signs of complications, allowing for timely interventions. The second benefit is remote patient monitoring. Wearable devices equipped with AI algorithms can continuously assess vital signs and other physiological parameters, enhancing patient safety and satisfaction.

Despite the promising applications, integrating AI into endometriosis surgery presents challenges:

Data Privacy and Security: Ensuring the confidentiality and integrity of patient data used to train AI systems is paramount. Compliance with regulations like HIPAA is necessary to protect patient information.

Algorithm Bias and Validation: AI models must be trained on diverse datasets to prevent biases that could affect diagnostic accuracy and treatment recommendations across different populations.

Regulatory Hurdles: AI-driven medical devices and software require rigorous validation and approval from regulatory bodies like the FDA to ensure safety and efficacy.

Cost and Accessibility: The implementation of AI technologies may be associated with high costs, potentially limiting access in resource-constrained settings.

The continuous evolution of AI technologies holds the potential to revolutionize endometriosis management in many ways:

Integration with Genomics: Combining AI with genomic data could unveil personalized therapeutic targets and advance precision medicine in endometriosis care.

Enhanced Collaborative Platforms: AI can facilitate better communication and data sharing among multidisciplinary teams, improving overall patient outcomes.

Education and Training: AI-driven simulation tools can enhance surgical training, allowing surgeons to refine their skills in a risk-free environment.

The integration of Artificial Intelligence into endometriosis surgery represents a significant leap forward in addressing the complexities of this pervasive condition. By enhancing diagnostic precision, improving surgical outcomes, and facilitating personalized care, AI has the potential to transform the standard of care for patients with endometriosis. Ongoing research, ethical implementation, and collaborative efforts among clinicians, researchers, and technologists are essential to harness the full benefits of AI while addressing the associated challenges. As technology continues to advance, AI stands poised to play an integral role in improving the lives of those affected by endometriosis.

Keywords: Artificial intelligence, Deep learning, Endometriosis, Personalized care, Surgery

Enhancing Machine Learning and Artificial Neural Network Models for Improved Diagnosis of Polycystic Ovary Syndrome (PCOS): A Comparative Approach Using Feature Selection and Hyperparameter Optimization

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Abstract

Background: Polycystic ovary syndrome (PCOS) is one of the most common hormonal disorders in women of reproductive age, potentially leading to complications such as infertility, type 2 diabetes, and cardiovascular diseases. Timely and accurate diagnosis of this syndrome is highly significant, as it can play a crucial role in reducing complications and improving patients' quality of life.

Method: This study aimed to enhance PCOS prediction using machine learning methods and an artificial neural network (ANN). Clinical data from 539 patients, of whom 178 were diagnosed with PCOS, were collected and analyzed. In the first phase, four machine learning models including decision tree, random forest, gradient boosting, and artificial neural network were applied without hyperparameter optimization or feature selection. In the second phase, feature selection methods, including ANOVA, mutual information, recursive feature elimination, and hyperparameter optimization using grid search were implemented.

Result: Results demonstrated that both feature selection and hyperparameter optimization led to significant improvements in model performance. Comparative analysis showed that optimized models, particularly the artificial neural network, performed more accurately in diagnosing PCOS.

Conclusion: Advancements in artificial intelligence and machine learning provide high diagnostic and classification performance for diagnosing PCOS, ultimately facilitating early detection of this disorder.

Keywords: Artificial neural network, Feature selection, Machine learning, Polycystic ovary syndrome (PCOS)

Ethical and Psychological Issues with AI in Infertility Treatment

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Abstract

The integration of artificial intelligence (AI) in infertility treatment raises significant ethical and psychological concerns that require careful consideration. Ethical concerns include issues related to autonomy and decision-making, where AI-driven recommendations may inadvertently compromise patient autonomy by pressuring individuals or couples into choices they are not fully comfortable with. Additionally, the privacy and security of sensitive data is a critical concern, as the handling of personal and medical information poses risks of data breaches and potential exploitation. The inherent bias and discrimination within AI systems, stemming from the data on which they are trained, can exacerbate inequalities in healthcare by producing unequal treatment recommendations based on factors such as ethnicity and socioeconomic status. Psychological challenges encompass the emotional impact on patients, as the data-centric approach of AI may neglect the individual emotional needs of those experiencing infertility. This reliance on technology could also diminish the vital trust and human connection between patients and healthcare providers, leading to a depersonalized experience that erodes therapeutic relationships. Moreover, the introduction of AI may induce stress and anxiety among patients, as the complexity of AI decision-making can create uncertainty regarding treatment processes and outcomes. Finally, there is a risk of over-reliance on AI, which may foster unrealistic expectations about treatment success, resulting in intense disappointment and emotional distress if outcomes do not align with these expectations. Addressing these concerns is essential for ensuring that AI enhances rather than detracts from the quality of care in infertility treatment.

Keywords: Artificial intelligence, Assisted reproductive technology, Infertility, Treatment, Psychology, Ethics

Design and Evaluation of an Intelligent Consultation System for Therapeutic Decision-Making in Andrology and Embryology: An Educational Approach

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Abstract

Background: The application of artificial intelligence (AI) in andrology and embryology has recently undertaken remarkable growth. Machine learning algorithms can efficiently analyze complex data such as embryo images and sperm characteristics to provide optimized treatment recommendations. New intelligent systems, such as Life Whisperer and other image-based models, have demonstrated significantly higher accuracy than traditional human methods for identifying embryo and sperm quality. In this context, intelligent systems can assist embryologists and andrologists in making more precise decisions for complex processes, such as embryo selection for transfer and analyzing male infertility conditions. This study focused on designing and evaluating an intelligent consultation system to aid therapeutic decision-making in andrology and embryology. Based on machine learning algorithms and deep neural networks, this system was designed to enable specialists to conduct a more precise assessment of clinical conditions in infertile patients by using comprehensive and complex datasets. Emphasizing the educational value of AI, this research aimed to train medical staff in effectively utilizing AI for therapeutic decision-making to improve accuracy and quality of care and increase treatment success rates.

Methods: This study involves the design of an intelligent system based on comprehensive clinical and imaging data. Data on sperm and embryo characteristics were collected from specialized laboratories and processed through deep learning models to serve as a consultation tool for selecting and assessing embryos and sperm. This system can assist specialists in increasing diagnostic and selection accuracy based on scientific data and intelligent recommendations. Training for this system also includes practical programs for healthcare staff to maximize the benefits of this technology in daily operations.

Results: Recent studies have shown that AI-based systems can achieve higher accuracy in sperm and embryo analysis processes than traditional methods. For instance, researchers at Massachusetts General Hospital have used intelligent algorithms for more precise embryo selection and to predict fertilization success. These systems, with their high accuracy, can identify embryos with the highest potential for development, reducing the need for multiple embryo transfers and lowering the risk of multiple births.

Conclusion: The development and implementation of AI systems in therapeutic decision-making for andrology and embryology can have a substantial impact on increasing the accuracy and quality of healthcare services. These systems enable specialists to make more precise and error-free decisions in the complex conditions of infertility. Based on this study's findings, it is recommended that healthcare centers adopt these systems in both educational and therapeutic processes to enhance accuracy, efficiency, and patient satisfaction.

Keywords: Andrology, Artificial intelligence, Deep learning, Embryology, Fertilization, Intelligent consultation system

Evaluating the Role of Artificial Intelligence in Monitoring and Enhancing Laboratory Environmental Conditions in Embryology to Improve Treatment Outcomes

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Abstract

Background: Due to the high sensitivity of embryo development stages, the embryology lab environment must be strictly regulated. As an advanced tool, artificial intelligence (AI) has the capability to continuously monitor and analyze environmental data, automatically applying necessary adjustments. Recent studies have shown that AI can positively impact embryo quality and fertilization success by reducing human error and enhancing precision in environmental control. This study assessed the role of artificial intelligence in monitoring and optimizing environmental conditions in embryology laboratories, aiming to improve the quality of infertility treatment outcomes. Laboratory conditions—such as temperature, humidity, and oxygen levels—significantly impact embryo growth and development. AI and machine learning systems can assist in precisely monitoring and controlling these conditions, optimizing environmental parameters, and increasing the likelihood of successful treatments.

Methods: This study utilized an AI-based system for collecting and analyzing environmental data in embryology labs. This system continuously monitors temperature, humidity, and other essential parameters and adjusts them when needed. The experimental group included several embryology labs equipped with AI systems, and their outcomes were compared to those of traditional labs.

Results: Results showed that AI-equipped labs provided optimal environmental conditions for embryo growth. Embryo growth and development rates in these labs significantly exceeded those in control samples. Furthermore, fertilization success rates in intelligent labs were reported to be 20% higher than those in conventional labs. Findings indicated that reducing temperature fluctuations and precisely controlling humidity with AI had a positive effect on embryo health.

Conclusion: Implementing AI for environmental monitoring in embryology labs can significantly improve infertility treatment outcomes. AI systems reduce human error and increase precision in environmental control, helping embryologists produce higher-quality embryos. This study recommends that infertility centers adopt this technology to optimize laboratory conditions and enhance treatment outcomes, ultimately leading to increased patient satisfaction and improved overall service quality.

Keywords: Artificial intelligence, Embryology, Fertilization rate, Patient satisfaction, Treatment outcomes

Evaluating the Impact of Artificial Intelligence Simulations on Enhancing Practical Laboratory Skills in Embryology and Andrology

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Abstract

Background: This study examined the impact of artificial intelligence (AI) simulations in strengthening practical laboratory skills in the fields of embryology and andrology. The primary objective was to assess the effectiveness of these simulations in improving precision and confidence among novice specialists and enhancing the quality of laboratory outcomes. AI and simulation technologies can create realistic scenarios and replicate laboratory environments, offering users a safe, risk-free opportunity to practice and master complex techniques.

Methods: This research evaluated a group of students and novice specialists who lacked experience in specialized embryology and andrology techniques. Over a four-week training period, this group used AI-based simulations that covered critical procedures, including sperm and embryo quality assessment, microscopy tool usage, and treatment decision-making scenarios. AI systems were employed to reconstruct images, simulate complex scenarios, and create interactive experiences, allowing participants to gain a near-realistic experience.

Results: The results showed that AI simulations significantly increased users' precision and confidence in executing laboratory techniques. Following the AI-based training, participants demonstrated enhanced skills in assessing sperm and embryo quality and performing specialized laboratory procedures with greater accuracy. Over 85% of users reported that the simulation experience improved their confidence and reduced anxiety when handling real-life scenarios. Additionally, their speed and precision in performing specialized tasks increased, and laboratory errors were notably reduced.

Conclusion: AI simulations, as educational tools, play a vital role in enhancing the practical skills of embryology and andrology specialists, allowing them to practice essential techniques without the requirement for real samples. This method not only aids in improving users' knowledge and abilities but also has the potential to enhance the overall quality of laboratory and clinical services. Incorporating AI simulations in educational settings is recommended to leverage this technology for elevating educational standards and optimizing learning processes.

Keywords: Andrology, Artificial intelligence, Embryology, Laboratory skills, Simulation technologies

Comparative Study of Machine Learning Approaches Integrated with Genetic Algorithm for IVF Success Prediction

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Abstract

Background: IVF is a widely-used assisted reproductive technology with a consistent success rate of around 30%, and improving this rate is crucial due to emotional, financial, and health-related implications for infertile couples. This study aimed to develop a model for predicting IVF outcome by comparing five machine-learning techniques.

Methods: The research approached five prominent machine learning algorithms, including Random Forest, Artificial Neural Network (ANN), Support Vector Machine (SVM), Recursive Partitioning and Regression Trees (RPART), and AdaBoost in the context of IVF success prediction. The study also incorporated GA (genetic algorithm) as a feature selection method to enhance the predictive models' robustness.

Results: Findings demonstrate that AdaBoost, particularly when combined with GA feature selection, achieved the highest accuracy rate of 89.8%. Using GA, Random Forest also demonstrated strong performance, achieving an accuracy rate of 87.4%. Genetic algorithm significantly improved the performance of all classifiers, emphasizing the importance of feature selection. Ten crucial features, including female age, AMH, endometrial thickness, sperm count, and various indicators of oocyte and embryo quality were identified as key determinants of IVF success.

Conclusion: These findings underscore the potential of machine learning and feature selection techniques to assist IVF clinicians in providing more accurate predictions, enabling tailored treatment plans for each patient. Future research and validation can further enhance the practicality and reliability of these predictive models in clinical IVF practice.

Keywords: AdaBoost, Artificial neural network, Genetic algorithm, Infertility, IVF success, Machine learning, Random forest, Recursive partitioning and regression Trees, Support vector machine

Management Strategies for Unexplained Infertility

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Abstract

Unexplained infertility refers to the absence of a definable cause for a couple's failure to achieve pregnancy after 12 months of attempting conception despite a thorough evaluation, or after six months in women aged 35 and older. A thorough evaluation typically includes documentation of ovulation, tubal patency, normal uterine cavity, normal semen analysis, and adequate ovarian reserve. The management of couples with unexplained infertility should balance the efficacy, cost, safety, and risks of various treatment alternatives. A common approach is to start with treatments that are resource-light and patient-directed such as lifestyle changes or timed intercourse. The strategy typically progresses sequentially to treatments requiring proportionately greater resources such as clomiphene citrate (CC) plus intrauterine insemination (IUI), and finally to high-resource interventions, including gonadotropin injections plus IUI, and in vitro fertilization (IVF). The approach to treatment should be individualized for each couple. In general, if a specific fertility treatment does not result in pregnancy after three cycles, alternative treatments should be considered. For women who do not conceive with clomiphene or letrozole/IUI in three to four cycles of treatment, some specialists proceed with IVF. IVF is the intervention that results in the highest per-cycle pregnancy rate in the shortest time interval, with up to 40 percent of cycles resulting in live births. However, IVF is also the most expensive treatment option. It is expected that the decision to use IVF is individualized by patient characteristics such as age, duration of infertility, previous treatment, and previous pregnancy. In women for whom IVF is not an option because of insurance, financial, religious, or personal reasons, some specialists offer either ovulation induction with injectable gonadotropins or laparoscopy.

Keywords: In vitro fertilization, Individualized treatment, Intrauterine insemination, Laparoscopy, Unexplained infertility

The Role of AI in Genetic Aspects of Recurrent Miscarriage

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Abstract

Recurrent miscarriage (RM) involves complex factors, with genetics being one of the most significant contributors. Artificial intelligence (AI) has emerged as a transformative tool to unravel these complexities. This abstract explores the genetic underpinnings of RM, the application of AI in genetic analysis, and its implications for both patients and healthcare providers. Genetic abnormalities are implicated in 50-70% of early pregnancy losses, categorized into chromosomal abnormalities, single-nucleotide variations (SNVs), and epigenetic changes. Chromosomal abnormalities include aneuploidies, which arise from errors during meiosis, and balanced translocations in parents that can lead to unbalanced translocations in embryos, often resulting in miscarriage. SNVs represent mutations in genes involved in placental development or immune regulation, while epigenetic changes, such as DNA methylation, can alter gene expression and influence fetal development without modifying the DNA sequence. AI enhances genetic analysis through big data processing and pattern recognition. AI algorithms analyze terabytes of genetic data from whole-genome sequencing (WGS) or whole-exome sequencing (WES), identifying subtle variations often overlooked by human analysts. Machine learning (ML) techniques recognize patterns in genetic variations across populations, detecting rare mutations shared by individuals with RM and elucidating multigenic contributions that increase miscarriage risk. Predictive AI models assess miscarriage likelihood by integrating genetic data with clinical variables such as maternal age, history of infertility, and hormonal profiles. These models can predict risks for specific pregnancies, guiding preimplantation genetic testing for high-risk individuals and offering actionable interventions, such as considering donor eggs or sperm when genetic abnormalities are identified. In assisted reproductive technologies (ART), AI enhances embryo selection and evaluation. AI assigns genetic viability scores to embryos based on chromosomal balance and critical gene expression, leading to higher implantation success rates and reduced miscarriage risks. Epigenetics plays a crucial role in embryonic development, but studying these changes is complex. AI models have been developed to identify epigenetic markers associated with RM and to predict the reversibility of harmful changes, guiding therapeutic approaches. AI accelerates research by enabling large-scale studies across diverse populations, identifying previously undetected genetic markers, and simulating the effects of genetic mutations to prioritize research efforts. Additionally, AI-powered clinical decision systems assist reproductive specialists in interpreting complex genetic reports and generating personalized treatment plans. However, the integration of AI in reproductive medicine faces

challenges, including data privacy concerns, potential biases in training data, and the need for clinical validation of AI predictions through trials to ensure safety and efficacy. Cost accessibility is also critical, as AI technologies must be cost-effective to benefit a broad range of patients. Future directions include AI-driven therapies, such as CRISPR-based solutions to correct mutations responsible for RM, integrating multi-omics data, and conducting longitudinal studies to track patients over time, linking genetic data with pregnancy outcomes to refine predictions and treatments. In conclusion, AI's ability to process vast genetic data, identify subtle patterns, and generate actionable insights is revolutionizing the management of recurrent miscarriage. By incorporating advanced AI systems into clinical practice, healthcare providers can offer personalized, effective solutions to alleviate the burden of miscarriage on families. As research and technology advance, AI holds the promise of unlocking answers to even the most complex cases of reproductive loss.

Keywords: Artificial intelligence, Assisted reproductive technology, Chromosol abnormalities, Epigenetic changes, Genetic analysis, Machine learning (ML) techniques, Recurrent miscarriage

Precision Oncology for Mucinous Adenocarcinoma: Integrating AI-Driven Drug Combinations and Network Meta-Analysis

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Abstract

Background: Mucinous adenocarcinoma, a unique subtype of cancer originating from epithelial tissue, is characterized by its production of mucin, constituting over 50% of tumor volume. While relatively rare, its occurrence in various glandular organs such as the stomach, breast, ovary, and lungs warrants attention due to its distinct pathological features. Given its potential for uncontrolled growth and metastasis, timely intervention is crucial to prevent severe impacts on patient quality of life and survival. Fortunately, mucinous tumors often exhibit less aggressiveness and favorable response to treatment, emphasizing the importance of prompt management. In this context, identifying optimal drug combinations becomes imperative for personalized therapy, leveraging multiple mechanisms to overcome potential resistance and maximize efficacy while minimizing adverse effects, especially in cases unresponsive to conventional treatments.

Methods: This study employed the RAIN protocol, comprising three key phases. Firstly, utilizing the Graph Attention Network model, drug combinations were suggested for treating mucinous adenocarcinoma. Each node in the graph model is a drug or a human gene/protein that acts as a potential target for adenocarcinoma, and the edges are P-values between them. Secondly, a systematic review was conducted across multiple databases including Web of Science, Google Scholar, Scopus, ScienceDirect, PubMed, and Embase, employing NLP techniques to identify relevant studies on the proposed drugs for treating mucinous adenocarcinoma. Finally, employing network meta-analysis, the efficacy of individual drugs and genes relative to each other was evaluated. All implementations were carried out using Python software.

Results: The efficacy of a proposed combination of drugs including cisplatin, fluorouracil, and capecitabine for treating mucinous adenocarcinoma was substantiated through a review of 30 studies. Statistical analysis revealed significant effectiveness levels, with p-values of 0.044 for the first drug, 0.018 for the combination of the first two drugs, and 0.012 for the selection of all three drugs in treating mucinous adenocarcinoma.

Conclusion: Given the significance of mucinous adenocarcinoma disease, it is imperative for health policymakers to leverage the findings of artificial intelligence within the RAIN protocol. By doing so, they can prioritize the healthcare needs of patients with mucinous adenocarcinoma and devise tailored drug combinations for effective treatment and management of the problem.

Keywords: Drug discovery, Graph Neural Network, Human genes/proteins, Machine learning, Mucinous adenocarcinoma, RAIN protocol

Applications of Artificial Intelligence in Patient Education: Perspectives and Challenges in the Field of Fertility and Infertility

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Abstract

Background: AI-driven patient education is rapidly expanding, leveraging vast data, intelligent tools, and deep learning systems to provide personalized health information and tailored treatment recommendations. In the context of fertility and infertility, AI can significantly enhance patient-provider interaction and increase patient satisfaction by providing customized and relevant information throughout the care journey. This paper explored the potential of artificial intelligence (AI) in patient education within the field of fertility and infertility. Effective patient education is crucial for enhancing self-care, reducing anxiety, and improving patient engagement in the treatment process. Given the need for patients to have a thorough understanding of their condition, AI can play a significant role in empowering them by delivering personalized educational programs and tailored content.

Methods: This study is based on a systematic review of existing literature and research on AI applications in patient education, with a particular focus on fertility and infertility. The primary focus is on methods such as virtual assistants, mobile health applications, and augmented and virtual reality technologies, which can facilitate patient education and follow-up.

Results: The findings of this study indicate that AI can assist patients in gaining a better understanding of their condition and in practicing self-care by providing up-to-date, precise information. For instance, virtual assistants can answer patient questions about treatment options and medications, while AI-based applications can deliver personalized lifestyle and dietary recommendations. Additionally, augmented and virtual reality can help patients comprehend treatment stages, which may help reduce anxiety. While AI holds significant potential in patient education, challenges such as data privacy concerns and cultural resistance to new technologies among some patients remain. Moreover, establishing standards for the safe and ethical use of AI in this domain is essential for optimal outcomes.

Conclusion: By personalizing content and offering continuous support, AI has the potential to revolutionize patient education in the area of fertility and infertility. This technology not only increases patient awareness and facilitates treatment processes but also aids healthcare providers in delivering more effective services. This study suggests that future research should focus on developing AI tools with a human-centered approach, directly aligned with the specific needs of patients in this field.

Keywords: Artificial intelligence, Human-centered approach, Infertility, Patient education, Personalized treatment

The Impact of Artificial Intelligence on Training Healthcare Staff in the Field of Infertility: A Strategy for Enhancing Efficiency and Improving Quality of Care

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Abstract

Background: In the field of infertility, specialized knowledge and skills play a crucial role in treatment success, making practical and up-to-date training for personnel essential. AI can elevate training for healthcare staff to a new level by utilizing data analysis, offering personalized training programs, and creating simulated educational scenarios. In recent years, AI has emerged as a powerful tool for improving education in specialized medical fields through its capabilities in data analysis and intelligent recommendations. In the field of infertility, where treatments are complex and sensitive, precise and specialized training for healthcare staff can lead to improved service quality and increased success rates of treatments. This study explored the influence of AI on the training process of healthcare personnel in infertility treatment centers and its effects on optimizing healthcare services.

Methods: In this research, a systematic review and analysis of reputable scientific resources was conducted, examining articles and studies on AI applications in training healthcare personnel in the infertility treatment sector. The tools used included decision support systems, AI-based simulations, and personalized learning platforms that help enhance learning and improve specialized skills among staff.

Results: The findings indicate that decision support systems can assist healthcare staff in diagnosing and treating infertility, allowing personnel to quickly analyze patient data. AI-based simulations also create treatment scenarios and simulated exercises, enabling doctors and nurses to strengthen their skills in more realistic conditions. Additionally, personalized learning platforms can offer training programs tailored to each individual's needs, enhancing the training process.

Conclusion: The use of AI in training healthcare staff in the field of infertility has created new opportunities for improving service quality and efficiency. This technology helps personnel keep their knowledge up to date and acquire essential skills for handling complex infertility treatments through targeted, needs-based training. It is recommended that infertility treatment centers leverage AI's potential in designing and implementing training programs, and that further research be conducted on the effects of this technology on treatment quality and patient satisfaction.

Keywords: Artificial intelligence, Infertility treatment, Patient satisfaction, Personalized programs, Quality of care

Investigating the Impact of Artificial Intelligence on Nursing and Analyzing Its Practical Application

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Abstract

Background: Artificial Intelligence (AI), as an emerging transformative technology, has influenced many healthcare processes. Given the vital role of nurses on the front lines of healthcare, the use of AI technologies in nursing can have a profound impact on the quality and accuracy of healthcare services. The purpose of the current study was to identify key AI applications in nursing, laying a foundation for future research and advancing the role of nurses in the development and use of this technology. In fact, the objective of this research is to identify AI tools that assist nurses in delivering better care and optimizing patient management. Various tools, such as decision support systems, mobile health technologies, and smart sensors, are utilized in healthcare settings to improve care quality and reduce human errors. This article also addresses the challenges of implementing AI in healthcare and proposes solutions to enhance its effectiveness.

Methods: This study employs a literature review and content analysis of scientific resources to examine published articles and reports on the applications of AI in nursing. The focus of this research is on AI tools such as clinical decision support systems, voice assistants, robots, and sensor- based technologies that directly impact the care process.

Results: The results indicate that decision support systems can provide more accurate diagnosis and effective predictions by analyzing hospital data and electronic health records. Remote health technologies and smart sensors also enable continuous monitoring of patients' conditions. Voice assistants and robots reduce the workload of nurses and improve interactions with patients, playing a significant role in delivering healthcare services. Simultaneously, challenges such as data security issues and healthcare staff's resistance to AI adoption require serious attention.

Conclusion: Successful implementation of AI in nursing requires active involvement of nurses in designing and evaluating these tools. Continuous training and feedback from nurses can improve AI service quality and increase its acceptance. Based on this study's findings, future research should focus on the psychological and social impacts of AI on healthcare staff and patients to develop smarter approaches for deploying this technology in healthcare environments.

Keywords: Artificial intelligence, Data security, Healthcare staff, Nursing, Robots, Voice assistants

Artificial Intelligence in Medical Laboratory

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Abstract

In the automated systems, blood samples are analyzed using microscopic images of stained blood cells. In this paper, the main objective was to provide the implementation of a deep learning –based automatic system to identify WBCs and RBCs in human peripheral blood smear. The proposed method consisted of 3 pre-processing, segmentation, and deep learning-based classification stages. In the pre-processing stage, color normalization was used to normalize the color appearance variability. Automatic image analysis methods can be significantly affected by different smear color appearances. The second task was the removal stage of the background and segmentation of the desired region of cells. In this stage, WBC and RBC probability map was obtained. In WBC probability map image, the pixels belonging to the WBCs had larger values than the pixels of non-WBCs. Finally, detected cells were cropped from the entire image by considering a patch around them. Our blood smear image database, used to train the proposed method, was composed of images. They were collected and labeled by experts at Avicenna Fertility Center. All patches were extracted from training images. The model was tested for a test set of 10 blood smear samples. Then, 100 images were captured from each blood sample and all images were analyzed by the proposed method. To evaluate cell differential counts, the performance of the proposed method was compared with the result of manual counting and Sysmex analyzer. The results of three automated methods, Sysmex, and manual differential cell counts were compared. For objective evaluation of the proposed system, three criteria of sensitivity, specificity, and accuracy were used. The manually labeled WBCs were considered as ground truth. The ground truth for all images was determined by an expert and used to validate the proposed method. The performance of the proposed method revealed a sensitivity of 0.972%, specificity of 0.985%, and accuracy of 0.982%. In this paper, a novel automated system was proposed for WBC and RBC detection and classification in blood smear images. The experimental results proved the performance of the proposed system.

Keywords: Automated systems, Cell differential count, Deep learning, Manual counting, Segmentation, Sysmex analyzer

Hysteroscopic Polypectomy Without Cycle Cancellation in IVF/ICSI Cycles: A Cross-Sectional Study

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Abstract

Background: The purpose of the current study was to evaluate the effect of hysteroscopic polypectomy during ovarian stimulation phase on the outcomes of in vitro fertilization and/or intracytoplasmic sperm injection (IVF/ICSI) cycles.

Methods: This cross-sectional study was performed in female infertility department of Royan Institute from January 2011 to December 2013. In total, 160 patients who were incidentally diagnosed with polyp/ polyps less than 20 mm in size during the stimulation phase for oocyte recoveries were recruited; of these, fifty-eight cases underwent hysteroscopic polypectomy non-randomly without cycle cancellation. Polyp resection was performed through hysteroscopic polypectomy during ovarian stimulation. The interval between polypectomy and embryo transfer (ET) was 3–17 days. The women who did not undergo hysteroscopic polypectomy and matched for polyp size were selected as the control group. The outcomes of IVF/ICSI cycles were compared between the groups.

Results: The data analysis showed the two groups were comparable in terms of patients' characteristics and stimulation outcomes. The implantation rate was not significantly different between groups (P = 0.3). The clinical pregnancy and live birth rates were similar between groups (%34.9 vs. %32.5 and %30.2 vs. % 27.9, P=0.9 and P=0.8, respectively). No pregnancies were observed with an interval of less than 5 days between hysteroscopic polypectomy and ET. Multivariable logistic regression analysis revealed that the interval between polyp resection and ET was a significant predictor for live birth rate (odds ratio: 1.2, confidence interval: 1.01–1.5, P = 0.04).

Conclusion: For the management of the polyps less than 20 mm in size which have been diagnosed during the stimulation phase, the application of hysteroscopic polypectomy without cycle cancellation does not improve the pregnancy and live birth rates. Therefore, it seems that the continuation of the treatment cycle and ignorance of these polyps is the appropriate treatment choice and the amalgamation of hysteroscopic polypectomy and frozen embryo transfer program could be the next treatment option.

Keywords: Embryo transfer, Hysteroscopic polypectomy, In vitro fertilization, Intracytoplasmic sperm injection, Live birth rates

Leveraging Artificial Intelligence in Assisted Reproductive Technologies: A Systematic Review on Addressing Data Privacy, Technical Challenges, and Enhancing Clinical Outcomes

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Abstract

Background: Artificial Intelligence (AI) is transforming Assisted Reproductive Technologies (ARTs) by offering tools for better diagnosis, personalized treatment, and improved clinical outcomes. Despite the potential benefits, significant challenges such as data privacy concerns, technical barriers in algorithm implementation, and the need for high-quality data hinder its widespread use. The purpose of this systematic review was to explore the current advancements in AI within the realm of ART, specifically addressing data privacy issues, technical challenges, and their impact on clinical outcomes.

Methods: A systematic search was conducted following PRISMA guidelines across databases including PubMed, Scopus, and IEEE Xplore from 2010 to 2023. The search terms included "Artificial Intelligence," "Assisted Reproductive Technologies," "Data Privacy," and "Technical Challenges." Inclusion criteria focused on peer-reviewed studies discussing AI applications in ART, while exclusion criteria filtered out studies unrelated to data privacy or technical hurdles. The Cochrane Risk of Bias Tool was employed to assess the study quality. The results were synthesized through qualitative analysis.

Results: Thirty-two studies, involving 12,875 participants, met the inclusion criteria. AI was shown to enhance embryo selection accuracy, improving diagnostic performance by 15% (95% CI: 10-20%). However, 40% of the studies highlighted concerns about data privacy, particularly regarding insufficient protection of patient information. Technical challenges, such as algorithm validation and generalizability, were noted in 50% of the studies. AI-assisted ART showed an 8% improvement in live birth rates (95% CI: 3-13%).

Conclusion: AI has demonstrated considerable promise in enhancing clinical outcomes in ART. However, challenges related to data privacy and technical validation limit its broader application. Addressing these issues through more secure data frameworks and generalized algorithm development is critical for future AI adoption in reproductive health.

Keywords: Artificial intelligence, Assisted reproductive technology, Data privacy, Technical validation, Reproductive health

A Systematic Review on Evaluating the Impact of Deep Learning Algorithms on Improving IVF Outcomes: Implementation Challenges and Opportunities to Optimize Infertility Treatment Protocols

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Abstract

Background: In vitro fertilization (IVF) is a crucial solution for couples dealing with infertility, but its success rates are still limited. Recent advancements in artificial intelligence, particularly deep learning (DL), have demonstrated the potential in enhancing IVF outcomes by refining embryo selection and adjusting treatment protocols. The purpose of this systematic review was to assess the influence of DL algorithms on IVF success rates, recognize implementation challenges, and explore opportunities for optimizing infertility treatment protocols.

Methods: A systematic search was conducted in PubMed, Scopus, and IEEE Xplore (2010-2023) using MeSH terms of "Deep Learning," "In Vitro Fertilization," "Embryo Transfer," "Artificial Intelligence," and "Treatment Outcome." Inclusion criteria encompassed clinical studies on deep learning for embryo selection and infertility treatment. Non-clinical, animal studies, and non-English articles were excluded. The Cochrane Risk of Bias Tool was used to assess the study quality. Data were synthesized narratively, with meta-analysis performed where feasible, calculating pooled odds ratios with 95% confidence intervals.

Results: A total of 18 studies, including 2,345 participants, met the inclusion criteria. Deep learning-based embryo selection improved pregnancy rates by 15-20% compared to conventional methods (OR 1.15, 95% CI 1.05-1.25). Challenges identified include variability in training datasets, lack of standardization, and ethical concerns regarding algorithm transparency. Despite these barriers, deep learning demonstrated significant potential in predicting successful embryo implantation and tailoring treatment protocols to individual patients.

Conclusion: This review emphasizes the potential of deep learning to improve IVF outcomes. However, additional research is needed to standardize models, address ethical considerations, and enhance data integration. The findings indicate that deep learning can play a crucial role in customizing infertility treatments, but practical implementation challenges need to be addressed.

Keywords: Artificial intelligent, Deep learning, Ethical considerations, In vitro fertilization, Infertility treatments

Artificial Intelligence-Driven Time-Lapse Monitoring in Assisted Reproduction Laboratories

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Abstract

Machine learning (ML) is one type of artificial intelligence (AI), which links the inputs and outputs to create an automated algorithm to develop ML; large datasets are essential for training the algorithm to find complicated patterns and associations faster than traditional statistical models that usually focus only on a small number of observations. Precise evaluation of embryo viability is a prime factor in maximizing pregnancy rate and optimizing the IVF treatment. This review incorporates time lapse monitoring (TLM) system and recent innovations in AI applications within ART programs in order to explore the impact of AI/ML on reproductive outcomes. This is the first review to cover technical aspects of TLM system as an AI technology in assisted reproduction technology laboratory. In recent years, several studies have reported promising results using AI to automatically analyze embryo images or videos. The objective of these methods is to rank embryos based on their implantation potential and to predict the likelihood of pregnancy for each embryo. However, the effectiveness of these strategies remains inconsistent across studies, and the consensus on best practices on the subject has yet to be achieved.

Keywords: Artificial intelligence, IVF treatment, Machine learning, Reproductive outcomes

Design and Development of Artificial Neural Network Model for Diagnosis and Segmentation of Ovarian Endometriosis

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Abstract

Introduction: Ovarian endometriosis is a prevalent gynecological condition characterized by the presence of endometrial-like tissue outside the uterus, leading to chronic pelvic pain and infertility. Detection of the pathology during the surgery is an important step in its treatment. In this study, a novel deep-learning method was introduced for the detection and segmentation of ovarian endometriosis.

Methods: Our approach leverages advanced neural network architecture to analyze medical imaging data, providing a robust and automated tool for pathology identification.

Results: The proposed method demonstrates high accuracy and reliability in distinguishing ovarian endometriotic lesions from healthy ovarian tissue resulting in more than 90% accuracies based on a cross-validation. By integrating the proposed deep learning model into clinical practice, diagnostic precision can be enhanced and fully automatic robotic surgery would be facilitated.

Conclusion: This advancement holds significant potential to improve patient outcomes and reduce the burden of ovarian endometriosis on women's health.

Keywords: Deep learning, Diagnostic precision, Infertility, Ovarian endometriosis, Pathology

Predicting Primary Ovarian Insufficiency Using Machine Learning Methods: A Systematic Review

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Abstract

Introduction: More than 3 out of 100 women are estimated to be dealing with primary ovarian insufficiency (POI), which can lead to female infertility. This study was conducted with the purpose of predicting POI and associated factors using machine learning (ML) methods.

Methods: Totally, 69 studies were reviewed which were sourced from PubMed, Web of Science, Science Direct, Cochrane Library, and Google Scholar databases to identify relevant research published between 2014 to 2024 using a peer reviewing search strategy with keywords of “Artificial Intelligence”, “Primary Ovarian Insufficiency”, “Premature Ovarian Failure”, “Ovarian Reserve”, and “Machine Learning”. Studies with duplicate data were excluded. The results of 13 eligible articles were extracted after selection of relevant findings according to inclusion and exclusion criteria.

Result: Finally, 13 eligible articles were chosen for this research. According to these studies, machine learning methods successfully identified genes related to POI. It can also predict the risk of POI and infertility in patients undergoing chemotherapy and cancer survivors. ML can determine ovarian reserve and estimate ovaries' age using clinical, biochemical, and sonographic parameters. Moreover, the association between POI and various medical co-morbidities can be evaluated via the technology.

Conclusion: Artificial intelligence and machine learning can accurately identify the relationship between POI and other medical features. This strategy can be used to predict POI and the risk of infertility in every individual which is beneficial in early intervention and improvement of patients' prognosis.

Keywords: Artificial intelligence, Machine learning, Ovarian reserve, Premature ovarian failure, Primary ovarian insufficiency

Navigating the Ethical Challenges of Artificial Intelligence and Biotechnology Integration in Infertility Treatment

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Abstract

The intersection of Artificial Intelligence (AI) and biotechnology has revolutionized infertility treatment, creating unprecedented possibilities for personalized and precise care. AI-powered tools, including predictive models, customized treatment plans, gamete selection, embryo evaluation, and fertility counseling have reshaped patient care practices. Additionally, the combination of AI with genomic analysis and gene-editing technologies allows for the identification of genetic factors underlying infertility, enabling targeted interventions and tailored therapeutics. However, the rapid integration of AI and biotechnology presents substantial ethical dilemmas that require thoughtful consideration and balanced oversight. Issues such as data privacy, genetic modification, and the extent of human intervention in reproduction call for cross-disciplinary discussions and robust regulations to ensure the responsible use of these technologies. This study adopts a multidisciplinary perspective to explore the ethical challenges stemming from the convergence of AI and biotechnology in infertility treatments. By drawing on scientific literature, clinical case studies, and expert insights, the advantages, hurdles, and ethical concerns associated with these cutting-edge technologies were assessed. Based on the findings, fostering open communication among healthcare providers, researchers, patients, and policymakers is critical to create comprehensive frameworks for managing ethical issues. In conclusion, the integration of AI and biotechnology in infertility treatment represents a double-edged sword, necessitating a careful balance between innovation and ethics. By proactively addressing both the potential benefits and inherent challenges, AI and biotechnology can be used to improve the effectiveness and ethical standards of infertility treatments, ultimately enhancing patient outcomes and fostering a more compassionate care environment.

Keywords: Artificial intelligence, Biotechnology, Ethical challenges, Healthcare provider, Infertility treatment

The Impact of Artificial Intelligence on Research

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Abstract

Background: Artificial intelligence (AI), as one of the most prosperous fields of technology in today's world, has a significant impact on many fields. The purpose of the current article was to examine the impact of artificial intelligence on research.

Methods: In this review study, information regarding the impact of artificial intelligence on research, was obtained from Persian and English databases including IranDoc, Magiran, Scopus, UpToDate, Elsevier, ProQuest, IranMedex, SID, EBSCO, Science Direct, Google Scholar, PubMed, and Web of Science using Persian keywords and their English equivalent for “Artificial Intelligence, Research, Article” based on MeSH (medical subject headings) from 2000 to 2024. Finally, 14 interventional studies, including clinical or semi-experimental, which were published between 2000 and 2024, were included in the study.

Results: In a review of all screened articles about artificial intelligence and research, most studies have reported that artificial intelligence can help authors improve the quality of research and increase the speed of content production.

Conclusion: Based on the findings of this study, it was found that artificial intelligence culminates in publication of more quality and comprehensive research. Therefore, it is recommended that researchers use artificial intelligence more extensively in various fields, including infertility.

Keywords: Article, Artificial intelligence, Infertility, Research

Using Artificial Intelligence in Infertility Treatment: An Ethical View

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Abstract

In order to evaluate the ethical issues caused by the use of AI in the treatment of infertility, firstly, the fields and methods of using this new technology in infertility treatment must be considered and evaluated. Artificial intelligence (AI) seems to be applicable in diagnosing infertility through medical data analysis to more accurately identify possible causes of infertility. Moreover, it is beneficial in predicting the success rate of treatment through data analysis and evaluating the probability of success of different treatment methods. Other potential areas are related to development of new treatments for infertility by designing novel drugs and personal treatment methods according to the medical needs and records of the patients. Through all these applications, the technology can bring changes in the evaluation and treatment of infertility. However, several ethical issues and challenges arise by the advent of the technology. The first is the problem of security as AI algorithms rely on huge information sources that are the result of collecting personal data. Who owns these data sources and how can they be used? What are the risks associated with the misuse of these resources and how do they threaten the privacy and security of personal information?. The issue of justice is a crucial aspect for consideration. Are the treatments obtained through the use of AI available to everyone or are they only for those who can afford them? Doesn't the use of AI in the treatment of infertility increase the current inequalities in access to health resources? The next concern is related to the problem of autonomy. Infertile people have complete autonomy over their choices in the field of reproduction. This autonomy depends on proper awareness of the risks and benefits of treatment methods. Does the application of AI in the treatment of infertility give the patients the possibility and authority to exercise complete autonomy? The problem of beneficence also raises several questions. what should we do with the possible harmful consequences of the use of AI in infertility treatment, consequences that could be morally relevant? The last concern is the problem of policy-making. How can we move forward by critically examining various ethical perspectives and creating a context for further discussions towards the design and formulation of policies and guidelines for the ethical and responsible use of AI in the treatment of infertility?

Keywords: Artificial intelligence, Beneficience, Ethics, Infertility treatment, Justice, Privacy

The Role of Artificial Intelligence in Evaluating and Treating Male Infertility: A Narrative Review

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Abstract

Background: Infertility is defined as the failure of couples to conceive over a period of 12 months or more of procreation without the use of any form of contraception, unless there is evidence of ovulatory, tubal, uterine, pelvic, or endocrinological diseases. Moreover, infertility affects couples with equal frequency, with male infertility accounting for 50% of cases. In the majority of cases, male infertility is related to semen parameters, including a decrease in sperm concentration, a decrease in the percentage of sperm with normal morphology (teratozoospermia), and a decrease in the percentage of sperm with progressive motility (asthenozoospermia) due to an increased production of reactive oxygen species (oxidative stress). In addition, the involvement of lipids in the pathways of spermatogenesis and fertilization has been suggested and is an emerging field of investigation, known as "lipidomics" with the method developed sharing the same name. Oxidative stress affects the integrity of the sperm plasma membrane, partly due to the susceptibility of sperm to peroxidation, resulting in a loss of motility and the ability to fuse with the oocyte. Moreover, levels of peroxidation, lipid, and alpha-tocopherol in semen have been shown to be associated with abnormal sperm morphology. In the last twenty years, research studies have been conducted to develop rapid and non-invasive routine diagnostic methods that can deliver accurate results of patients within a predicted time, as a crucial step in treatment procedures. Therefore, the purpose of this study was to investigate the role of artificial intelligence (AI) in treatment of male infertility.

Methods: In the present review article, both original and review studies published in PubMed, Science Direct, Scopus, and Google Scholar database were evaluated using the keywords of “male infertility”, “assisted reproductive technologies”, “sperm morphology”, “artificial intelligence”, and “seminal quality”.

Results: By reviewing all the selected articles, it was found that artificial intelligence (AI) has the capability to enhance the accuracy of sperm selection by identifying the highest quality sperm for fertilization, resulting in improved pregnancy rates and reduced time and cost for patients.

Conclusion: The purpose of this narrative review was to provide a comprehensive reinvestigation, considering state-of-the-art research about the potential multiple roles of artificial intelligence in the evaluation of male infertility, while suggesting possible therapeutic interventions. Artificial intelligence is defined as the ability of a device to interpret and predict a response according to provided data points. AI in medicine is a rapidly

growing and complex field; AI is creating strong connections between genes, imaging, metabolomics, and other data sources, offering unique opportunities for the near future, suggesting new diagnostic and prognostic solutions in clinical practice. Today, the use of AI is mainly based on machine learning (ML), the ability of a computer system to improve performance by incorporating data-driven information, and deep learning, a technique of artificial intelligence based on neural networks with an architecture consisting of many layers of processing.

Keywords: Artificial intelligence, Assisted reproductive technologies, Male infertility, Seminal quality, Sperm morphology

Artificial Intelligence Challenges in Gynecology and Midwifery

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Abstract

Background: The application of artificial intelligence (AI) in gynecology, midwifery, and other domains in medicine has gained attention as a practical and innovative approach to providing care services. This technology's advancement has made it possible to improve decision-making, providing better care for patients, and enhancing the performance of healthcare systems. AI can also support nurses' clinical decision-making in complex care situations or conducting tasks that are removed from direct patient interaction, such as documentation processes. However, some new ethical challenges arise with the use of AI in healthcare.

Methods: A systematic search of the target literature was conducted, resulting in 25 articles published between 2015-2023 using keywords of "Artificial Intelligence", "Ethical Aspects", "Health Care", "Midwifery", and "Gynecology" that all of them met the criteria for evidence level 1. The studies were sourced from PubMed, EMBASE, and Cochrane Library. Data were analyzed to assess the ethical challenges of AI in gynecology.

Results: AI systems have significant limitations in healthcare, particularly in gynecology and midwifery. They cannot provide physical care, such as administering medications or performing procedures, which are important aspects of health care, nor can they offer the personal touch and emotional support that patients often need. Additionally, medical care in gynecology often involves complex situations that require critical thinking and decision-making and a lack of comprehensive data culminates in complications. The use of AI also raises ethical considerations, including concerns related to patient privacy and data security. Furthermore, implementing AI systems can be expensive and the collection of personal and sensitive data necessitates security measures to protect against potential cyberattacks. As a result, the integration of AI in gynecology and midwifery raises several ethical challenges that should be carefully considered.

Conclusion: Although using AI can be a supporting tool for gynecologists and midwives, it cannot be considered as a substitute for them. Physicians play a crucial role in providing healthcare services to patients, and besides providing care to the patient, they also assist in emotional and psychological support, which contributes to improving patients health.

Keywords: Artificial intelligence, Ethical aspects, Health care, Gynecology, Midwifery

AI-Driven Biotechnology for Drug Discovery in Personalized Infertility Treatment

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Abstract

Background: Infertility is a complex medical condition that affects many individuals worldwide. The rise of personalized medicine offers new hope for tailored treatment plans by integrating biotechnology and artificial intelligence (AI) to enhance drug discovery for patients with infertility. This research paper examines the potential applications of AI-driven biotechnology in genomic analysis, predictive modeling, and biomarker identification to improve treatment efficacy and minimize side effects.

Methods: The study focuses on three main areas: genomic analysis to identify genetic factors contributing to infertility and inform drug development, predictive modeling for high-throughput screening and optimization of drug candidates, and biomarker identification to facilitate patient stratification and predict response to treatment. The paper utilizes a comprehensive literature review, data analysis, and expert insights to evaluate the effectiveness of AI-driven biotechnology in personalized infertility treatment.

Results: The integration of AI and biotechnology has demonstrated promising results in improving drug discovery for infertility. Genomic analysis, predictive modeling, and biomarker identification have shown the potential in enhancing treatment efficacy and minimizing side effects. The study also highlights the significance of collaboration among experts in biotechnology, AI, and reproductive medicine to maximize the benefits of personalized medicine.

Conclusion: AI-driven biotechnology presents a transformative approach to infertility treatment. By tailoring treatment plans and developing targeted therapies, healthcare professionals can significantly improve patient outcomes and shift the paradigm towards patient-centered, individualized care. Continued research and collaboration in this field will further advance personalized medicine, offering hope to individuals affected by infertility.

Keywords: Artificial intelligence, Biomarker identification, Biotechnology, Drug discovery, Genomic analysis, Infertility, Personalized medicine, Predictive modeling

Revolutionizing Reproductive Health: AI's Role in Infertility and ART

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Abstract

Background: This article reviews the transformative impact of artificial intelligence (AI) on infertility and its unpredictable future. Infertility is a significant global health issue, affecting a considerable percentage of couples of reproductive age worldwide. Traditional approaches to diagnosing and treating infertility often involve invasive procedures, long treatment durations, and emotional distress for those affected. However, advancements in AI hold the potential to transform the landscape of reproductive health by improving diagnosis, personalizing treatment, and enhancing patient care. AI has the potential to improve infertility diagnosis and assisted reproductive technology (ART) outcomes, particularly concerning pregnancy and live birth rates, especially in cases with recurrent ART failure. This paper also addresses the ethical and legal considerations of using AI in healthcare, emphasizing the importance of privacy, security, and ethical decision-making.

Methods: This review study was conducted by searching databases such as PubMed, SID, Google Scholar, and Civilica using the keywords of "artificial intelligence (AI)," "infertility," "assisted reproductive technology," "oocyte," "embryo," and "legal and regulatory frameworks" without any time restrictions. A selection of articles was made, of which a subset was examined according to the study's objectives.

Results: AI is poised to revolutionize infertility treatment by enhancing diagnostic accuracy, personalizing treatment plans, and optimizing IVF processes for better success rates. It also offers cost efficiencies and supports telehealth initiatives to improve patient communication and emotional care. Addressing ethical and regulatory concerns will be crucial for ensuring the equitable use of AI in reproductive health.

Conclusion: Based on the findings of the study, the transformative potential of AI can be emphasized in enhancing perinatal care and balancing technological innovation with ethical and equitable healthcare practices.

Keywords: Artificial intelligence, Assisted reproductive technology, Infertility, Personalized treatment, Reproductive health

The Use of Artificial Intelligence in Examining Frozen and Fresh Embryos for Transfer in Assisted Reproductive Technology

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Abstract

Background: Considering the great importance of embryo selection in the successful process of infertility treatment, the present study was designed and implemented with the aim of using artificial intelligence (AI) in examining frozen and fresh embryos for transfer in the process of assisted reproductive technology.

Methods: The current study is a systematic review conducted in 2024, involving the following steps: formulating the study question, searching in databases including Google Scholar, PubMed, Scopus, Cochrane Library, Science Direct, Web of Science, and the Scientific Information Database (SID). Searches were performed using keywords such as "pregnancy outcome", "artificial intelligence", " machine learning ", "assisted reproductive technology", " embryo", and "thin", along with their English equivalents. Next, related studies from 2015 to 2024 were identified. After screening the titles, abstracts, and full texts of 1153 studies, 16 studies were finally selected for inclusion. Screening of the quality of the studies was done by the risk assessment checklist of interventional studies and the Newcastle-Ottawa scale checklist. Then the findings were classified.

Results: In this study, 16 studies were examined; in all studies, embryos were evaluated from the first to the sixth day. Some of these studies were cohort studies, and it was reported that evaluations with artificial intelligence algorithm is superior to visual examination, according to the report of 10 comparative articles. In cross-sectional studies, it was reported that artificial intelligence models achieved an average accuracy of 71.3% in predicting fetal morphology grades, as documented in seven articles. Artificial intelligence models in predicting clinical pregnancy through the use of clinical treatment information of the patient had an average accuracy of 63.2%, which was reported in six articles.

Conclusion: The results of this study indicate that artificial intelligence is very useful in embryo selection, which is important in the infertility treatment process.

Keywords: Artificial intelligence, Assisted reproductive technology, Embryo selection, Machine learning

Role of Artificial Intelligence in Predicting the Starting Dose of Gonadotropins in ART Cycles

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Abstract

Background: Application of Artificial Intelligence (AI) in reproductive medicine is extensively utilized to enhance decision-making processes. One important application relates to the prediction of the starting dose of gonadotropins in assisted reproductive technology cycles, mainly for treatment individualization aiming at the optimization of ovarian response, improvement of outcomes while minimizing risks such as ovarian hyperstimulation syndrome (OHSS). The aim of this narrative review was to synthesize current studies reporting on the role of AI in predicting the starting dose of gonadotropins in ART cycles, with a focus on methods, algorithms, and outcomes associated with AI driven dose optimization.

Methods: A comprehensive search through databases including PubMed, Google Scholar, and ResearchGate was performed. A combination of the following phrases was used: "artificial intelligence", "gonadotropin dosing", "ART cycles", "IVF", and "machine learning algorithms". Totally, 25 relevant studies that were published in the years 2015 to 2024 were selected. Studies included were reviewed for relevance, inclusion of gonadotropin dosing in ART, inclusion of AI or machine learning methods, reporting of quantitative outcomes related to dosing accuracy and clinical results. Excluded were those without explicit mentions of application of AI and those lacking statistical rigor. Information collected from these studies included patient characteristics at baseline, which comprised age, body mass index, anti-Müllerian hormone levels, and antral follicle count; the accuracy of the predictions, clinical pregnancy rates, and incidence of OHSS were evaluated.

Results: The 25 analyzed studies showed that AI algorithms, when incorporating variables such as age, BMI, AMH, and baseline FSH, predicted the optimal starting dose in the IVF cycle with a mean accuracy of 85% ($p<0.01$). Among these, one study, which had a total of 938 patients, could achieve 90% prediction accuracy with the help of a machine learning model comprising 6 key reproductive parameters ($p<0.001$). Another study demonstrated that with the help of AI against traditional clinician-based methods in optimizing dosing, the incidence of OHSS could be reduced by 15%. On average, AI models contributed to a 12% increase in clinical pregnancy rates across studies ($p<0.05$).

Conclusion: AI has significant potential to optimize gonadotropin dosing in ART cycles, enhancing both safety and effectiveness. However, the clinical implementation of AI algorithms beyond this will require further standardization before personalized reproductive care can be offered.

Keywords: Artificial intelligence (AI), Assisted reproductive technology (ART), Gonadotropin dosing, Machine learning, Ovarian hyperstimulation syndrome (OHSS)

Evaluating the Efficacy of Nursing Interventions on Fertility Outcomes and Their Influence on Family Health Dynamics

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Abstract

Introduction: Infertility presents major challenges for individuals and families, often resulting in emotional and psychological stress. Nursing interventions, including counseling, education, and lifestyle support play a crucial role in addressing these challenges. However, the specific effects of these interventions on fertility outcomes and family health dynamics require further exploration. The purpose of the current review was to assess the impact of nursing interventions on improving fertility rates and their broader implications for family health.

Methods: A systematic search was conducted across PubMed, CINAHL, and Cochrane Library, targeting studies published between 2010 and 2023. Search terms included "nursing interventions", "fertility outcomes", "family health" and "reproductive health". Inclusion criteria involved randomized controlled trials and observational studies focusing on nursing interventions related to fertility and family health. Studies without precise intervention details or fertility outcome data were excluded. The risk of bias was assessed using the Cochrane Collaboration tool. Data were synthesized qualitatively, and meta-analysis was performed where applicable.

Results: Fifteen studies involving 1,200 participants were analyzed. The interventions, which included counseling and lifestyle modifications, improved fertility outcomes in ten studies (involving 900 participants), with a summary odds ratio of 1.45 (95%CI: 1.20-1.75). Positive effects on family health, such as mental well-being and relationship quality, were observed in 12 studies (involving 1,050 participants). The meta-analysis revealed a 25% increase in pregnancy rates among participants receiving nursing interventions compared to control groups, with a notable decrease in anxiety and stress levels.

Conclusion: The findings suggest that nursing interventions significantly improve fertility outcomes and family health dynamics. Further research is needed to optimize nursing strategies and expand support for families affected by infertility.

Keywords: Cochrane collaboration tool, Family health dynamics, Nursing interventions, Pregnancy rates

The Effectiveness of Cognitive- Behavioral Therapy on Psychological Well-Being in Infertile Women: A Randomized Controlled Trial

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Abstract

Background: Psychological well-being is a psychological variable that affects infertile women. This study was designed to investigate the effect of cognitive-behavioral therapy (CBT) on the psychological well-being of infertile women.

Methods: In total, 68 women with infertility were randomly allocated into two groups: CBT group (n=34) and control group (n=34). Women in the CBT group were classified into two sub-groups of 12 and one group of 10, and each sub-group received eight sessions of counseling (each session lasting 120 min). Data were collected via a demographic questionnaire using the 18-item short-form Ryff psychological well-being scale for measuring psychological well-being. For statistivcal analysis in this study, independent and paired t-tests, chi-square, repeated measures, and ANCOVA tests were applied to analyze the data.

Results: Two women from the case group and three women from the control group were withdrawn from the study, leaving 32 women in the case and 31 women in the control group. The scores of general psychological well-being and self-acceptance, positive relationship, autonomy, purpose in life, personal growth, and environmental mastery dimensions improved in the CBT group after the intervention. The scores were also significantly better in the CBT group than those in the control group ($p<0.001$).

Conclusion: The practice of counseling using CBT can improve all aspects of psychological well-being, including self-acceptance, positive relationship, autonomy, purpose in life, personal growth, and environmental mastery in women with infertility.

Keywords: Cognitive behavioral therapies, Infertility, Psychological well-being

Reviewing the Achievements and Findings of Artificial Intelligence in Artificial Insemination

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Abstract

Background: One of the human needs is reproduction, and infertility is one of the challenges of reproduction. In vitro fertilization (IVF) is a beacon of hope for millions of people who struggle with infertility. Artificial intelligence (AI) represents a significant leap in human development. Its achievements can be leveraged to enhance efficiency and minimize errors in various processes. In this article, the achievements and findings of artificial intelligence in the path of artificial insemination were examined.

Methods: This narrative review article has been conducted using articles related to the achievements of artificial intelligence in artificial insemination from 2020 to 2024. In this article, a study has been done on 40 articles from reliable scientific databases such as PubMed and Google Scholar.

Results: Embryo evaluation and selection represent the culmination of the entire in vitro fertilization (IVF) process. It aims to select the 'best' embryos from a larger cohort of fertilized oocytes, most of which will be deemed non-viable due to abnormal development or chromosomal imbalances. This technology uses AI models and algorithms to analyze extensive data sets and predicts patterns in a much precise way comparing to traditional ways. Therefore, it will have a huge effect on decision making and choosing the “best” embryos.

Conclusion: Artificial intelligence has made significant achievements in artificial insemination. Controlling and monitoring this path and preventing errors in the fertilization process and successful fertilization and finally controlling the pregnancy process and fetal growth are among the achievements of using artificial intelligence. However, artificial intelligence can also make mistakes without supervision from the treatment staff. Therefore, its use in this context should be monitored by doctors.

Keywords: Artificial insemination, Artificial intelligence, Fetal growth, In vitro fertilization

How Systemic Lupus Erythematosus (SLE) Affects Male Fertility

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Abstract

Background: Systemic Lupus Erythematosus (SLE) can affect the male reproductive anatomy in several ways. Some men with lupus may have increased concentrations of both follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which are the reason for production of testosterone by testicles. These levels may be abnormal because of lupus-related damage to the pituitary gland. High levels of both FSH and LH are linked to infertility. Men with SLE are also 14 times more likely to have Klinefelter syndrome, characterized by the presence of an extra X chromosome. This can cause infertility and reduce testosterone level. Lupus nephritis creates problems for men as well. It's associated with erectile dysfunction and reduced production of sperm. The hormonal imbalances created by hemodialysis are linked to infertility in men similar to women.

Methods: An extensive search was conducted across electronic databases, including PubMed, Medline, Embase, Google Scholar, and ResearchGate, and explored the available English-language literature. The MeSH terms utilized were "Lupus" or "Male"; "Infertility".

Results: Some conditions that are common in people with lupus may also contribute to infertility. Cytomegalovirus and Epstein-Barr virus infections are more common in people with lupus and have been implicated in infertility. Autoimmunity and immunosuppressant drugs may make people with lupus more susceptible to other common infections that can impair fertility. Lupus nephritis may cause infertility through dysfunction of the hypothalamus and pituitary glands. It's treated with hemodialysis, which can cause hormonal imbalances that can lead to infertility. In men, two common lupus drugs, namely methotrexate and sulfasalazine, can reduce sperm count and thus lead to infertility. Erectile dysfunction may also be a significant problem in patients with lupus.

Conclusion: Infertility and sexual dysfunction in men with SLE are relatively overlooked issues. The gonadal function may be affected in men with SLE. Hypogonadism is characterized by reduced testosterone and/or sperm production in the testes.

Keywords: Hypogonadism, Male fertility, Pituitary glands, Sexual dysfunction, Systemic lupus erythematosus

Diagnosis of Polycystic Ovary Syndrome (PCOS) Using Machine Learning Algorithms

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Abstract

Background: Polycystic ovary syndrome (PCOS) constitutes a significant endocrine and metabolic disorder, impacting approximately 6–20% of women within the reproductive age. Due to aberrant follicular development, PCOS can lead to anovulatory infertility as well as diminished quality of oocytes or embryos. The comprehensive diagnostic approach primarily entails a combination of pelvic ultrasound alongside biochemical assays of specific parameters indicative of PCOS. Given the challenges associated with the diagnosis of this prevalent hormonal disorder, the integration of blood tests, clinical symptoms, and additional parameters, augmented by artificial intelligence, may yield a novel and streamlined methodology for diagnosis. To address this issue, an intelligent system was proposed which is designed to facilitate the early detection and prediction of PCOS treatment utilizing machine learning algorithms.

Methods: In order to ascertain whether an individual woman is afflicted by PCOS, six distinct machine learning classifiers, which include random forest, support vector machine (SVM), logistic regression, naïve Bayes, Bayesian network (BN), and multilayer perceptron (MLP) were employed. The dataset used for training and testing is available on KAGGLE (https://www.kaggle.com/datasets/prasadbobby/pcosdata). The implementation of the machine learning model was carried out using Jupyter Notebook.

Results: The SVM and random forest classifiers demonstrated superior reliability and accuracy in comparison to alternative methods, achieving respective accuracy rates of 89.65% and 89.46%, respectively. The sensitivity and specificity metrics for the SVM and random forest models were recorded at 80.8% versus 77.4% and 94% versus 95.3%, respectively.

Conclusion: Women diagnosed with PCOS predominantly experience significant weight gain, hirsutism, acne vulgaris, alopecia, skin hyperpigmentation, and irregular menstrual cycles, which can culminate in infertility. The system proposed in this research facilitates the early identification and prediction of therapeutic interventions for PCOS.

Keywords: Bayesian network (BN), Logistic regression, Machine learning algorithms, Multilayer perceptron, Naïve bayes, Polycystic ovary syndrome (PCOS), Random forest, Support vector machine (SVM)

Artificial Intelligence and Infertility Treatment

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Abstract

Today, artificial intelligence (AI) is used as a powerful tool in the field of treatment, including infertility treatment. In this article, the wide applications of artificial intelligence in field of treatment, from predictive modeling to image processing and personalized treatments are discussed. Artificial intelligence algorithms are widely used in estimating the success rate of embryo implantation and the success rate of in vitro fertilization (IVF) by analyzing big data obtained from patients and their clinical results. In addition, AI helps in embryo selection and sperm quality assessment by image processing and increases accuracy and stability compared to traditional methods that rely solely on the knowledge and experience of the embryologist. This review also explores the role of AI in adjusting treatment protocols, optimizing drug doses, and minimizing the risk of disease, thereby improving overall patient care and efficiency. However, this field is plagued with challenges and limitations, such as data privacy concerns, the need for big data, and ethical considerations. By identifying these limitations and potential areas for future research, this review provides a comprehensive overview of the current capabilities of AI and its promising potential to revolutionize infertility treatment.

Keywords: Artificial intelligence, Embryo implantation, Ethical considerations, Image processing, Infertility treatment

The Application of Artificial Intelligence in Evaluation of Oocytes

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Abstract

Background: One of the most important issues regarding the success of assisted reproductive technology (ART) is the evaluation of oocytes. Considering the importance of this issue, the aim of the current study was to investigate the use of artificial intelligence in the evaluation of oocytes.

Methods: The current study is a systematic review in 2024 with the steps of designing the study question, searching in Google Scholar search engine, and PubMed, Scopus, Cochrane Library, ScienceDirect, Web of Science, and Scientific Information Database (SID) databases. Magiran and SID were searched with keywords such as "Follicular monitoring", "Artificial intelligence", "Machine learning", "Oocyte maturation", "Evaluation", " Quality", " Hormone therapy", and "Morphology". Subsequently, related studies from 2019 to 2024 were identified and selected. After screening the titles, abstracts, and full texts of 131 studies, a total of 6 studies were included. Screening of the quality of the studies was done by the risk assessment checklist of interventional studies and the Newcastle-Ottawa Scale checklist. Finally, the findings were classified.

Results: According to the results of 6 studies, artificial intelligence was used for various applications: predicting oocyte maturation (average accuracy of 64.1%), evaluation and classification of oocyte quality (average accuracy of 76.8%), predicting the need for hormone therapy and therapeutic intervention (average accuracy of 57.6%), and checking the abnormalities of oocyte morphology (average accuracy of 43.9%). Comparing machine samples analyzed by artificial intelligence with evaluations conducted by humans, it was shown that the use of artificial intelligence appears to be more effective

Conclusion: The results of this study indicate that artificial intelligence is very useful in the evaluation of oocytes, which is important in the process of infertility treatment.

Keywords: Artificial intelligence, Evaluation, Morphology, Oocyte maturation, Oocyte quality

The Main Obstacles to Implementing Artificial Intelligence (AI) for Predicting Assisted Reproductive Technology (ART) Success: A Narrative Review

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Abstract

Background: In reproductive medicine, artificial intelligence (AI) methods have the potential to be utilized by medical professionals to improve the identification of the most viable sperm, oocyte, and embryo and to generate effective and safe predictive models. The advancement of AI in medicine has been cautious and methodical, yet there are some questions about its efficiency. This review article examined the significant obstacles to implementing AI in assisted reproductive technology (ART).

Methods: Key findings were identified by searching Google Scholar, PubMed, Scopus, and Web of Science databases. The search terms were "artificial intelligence, assisted reproductive technology, implementation, prediction, and obstacles." Subsequently, ten relevant articles were selected for comprehensive review.

Results: The application of AI in ART faces several significant hurdles, one of which is the need for more data for training AI models that most of them rely on small retrospective samples, affecting the models' performance and applicability. The lack of extensive randomized controlled trials makes it difficult to validate the external validity of these algorithms. The lack of uniform evaluation of embryos in different laboratories leads to inconsistencies that complicate the interpretation of the results. The integration of AI aims to reduce human bias in embryo selection. However, the final decision on transfer still depends on the specialists who may introduce their own biases when interpreting AI recommendations. The legal framework for validating AI systems in reproductive medicine is still in its early stages, which complicates broad acceptance and confidence. Technical limitations, such as difficulties in training specific machine learning models and the need for statistically independent input variables, complicate the effective implementation of AI in ART.

Conclusion: Overcoming the mentioned challenges is critical to successfully integrate AI into assisted reproductive technology (ART) and improve outcomes for infertile patients.

Keywords: Artificial intelligence, Assisted reproductive technology, Machine learning methods, Predictive models, Reproductive medicine

The Virtual Twin System Is a Promising Tool in Evolution and Prediction of Embryos Resulting From In Vitro Fertilization (IVF)

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Abstract

Background: A digital twin is a virtual representation that mirrors a physical object or system. It encompasses the entire asset lifecycle, continuously updating through real-time data collected via sensors. This allows for simulations and analyses to predict performance issues and suggest optimizations. Unlike traditional simulations, which may focus on specific processes, digital twins can run multiple simulations simultaneously, providing a more comprehensive understanding of the system's dynamics. One of the strengths of this powerful system is the ability to track embryo health indicators and personalize treatment plans.

Methods: Articles were extracted without time limit from Web of Science, PubMed, and Google Scholar databases. The inclusion criteria included studies that were in line with the research objective.

Results: A virtual twin system integrates real-time data from embryos with computational modeling to simulate and predict developmental outcomes. This technology can analyze various factors influencing embryo viability and development, potentially leading to improved success rates in IVF procedures. For example, in prediction of embryo viability, recent advancements include the development of artificial intelligence systems that assess blastocyst viability by analyzing images and associated clinical data. A previous study reported an AI model named FITTE that improved prediction accuracy for clinical pregnancy outcomes compared to traditional scoring systems. Regarding Gene Regulatory Network dynamics, research has demonstrated the creation of digital twins that replicate gene expression dynamics in early embryos. These models allow scientists to manipulate gene expression patterns theoretically, providing insights into how regulatory networks evolve and function during early development stages. Data-driven approaches, particularly the use of single-cell RNA sequencing (scRNA-Seq) has been pivotal in constructing digital twins of embryos, capturing detailed information about gene expression at various developmental stages. This data-rich approach aids in understanding the transition from pluripotency to specialized cell types, which is crucial for optimizing IVF protocols.

Conclusion: Virtual twin systems represent a promising frontier in reproductive technology, combining computational modeling with biological data to enhance the understanding and outcomes of in vitro fertilization (IVF) processes.

Keywords: Computational modeling, In vitro fertilization, Personalized treatment, Single-cell RNA sequencing, Virtual twin system

The Early Versus Standard Administration of Cabergoline to Prevent Ovarian Hyperstimulation Syndrome (OHSS) in Patients with Polycystic Ovary Syndrome (PCOS) Undergoing ICSI Cycles: A Randomized Clinical Trial

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Abstract

Background: The effect of cabergoline on reducing the incidence rate of ovarian hyperstimulation syndrome (OHSS) has been confirmed by several studies. However, the significant question under discussion is when cabergoline should be started to maximize its effectiveness in reducing the occurrence and severity of OHSS.

Methods: A clinical trial conducted at Arash Women's Hospital from March to November 2023 included 200 infertile women with polycystic ovary syndrome (PCOS) who were at risk of OHSS during IVF/ICSI treatment. Participants were divided into two groups: an experimental group receiving cabergoline from the start of GnRH antagonist administration for 15 days, and a control group receiving cabergoline for 8 days after oocyte trigger. Measurements of hematocrit (Hct) percentage, serum creatinine (Cr), sodium (Na), potassium (K) levels, and abdominal circumference were taken three days after ovum pick-up. The study monitored patients until menstruation and focused on the occurrence and severity of OHSS as primary outcomes.

Results: The data analysis showed that the two groups were comparable in terms of basic characteristics. It was revealed that the OHSS rate in the early administration group was significantly lower than control group (14% vs. 47%, $p<0.001$). In the study group, the severity of all OHSS cases was mild, while in the control group, moderate severity of OHSS was also reported ($p<0.001$).

Conclusion: Earlier initiation of cabergoline from the time of administration of the GnRH antagonist compared to its initiation from the day of oocyte triggering has more effectively reduced the rate and severity of OHSS and improved patient's satisfaction.

Keywords: Cabergoline, Drug administration schedule, Ovarian hyperstimulation syndrome, Polycystic ovary syndrome

Investigating Artificial Intelligence in Infertility: A Review Article

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Abstract

Background: Infertility is a significant health concern affecting millions of individuals worldwide. With advancements in technology, artificial intelligence (AI) has emerged as a novel tool for diagnosing and treating patients with infertility. The purpose of the current study was to review the application of AI in infertility within Iran.

Methods: A literature search was conducted using keywords related to artificial intelligence, infertility, and emerging infertility technologies across Google Scholar, PubMed, IranDoc, Scientific Information Database (SID), and Magiran.

Results: The study indicates that AI can enhance treatment methods, such as in vitro fertilization (IVF), by analyzing historical data to aid specialists in selecting optimal treatment plans for individuals, thereby improving success rates. AI also facilitates the identification of infertility causes, with machine learning algorithms analyzing complex datasets to uncover hidden patterns. This technology enables rapid diagnosis of hormonal disorders and genetic issues.

Conclusions: The findings suggest that AI can improve patients' quality of life and treatment success rates in infertility. It holds significant potential for advancing infertility treatment methods and serves as an effective solution in this field.

Keywords: Artificial intelligence, Infertility, New infertility technologies

In Silico Studies and Female Infertility

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Abstract

In silico studies of female infertility identified SNPs that influence the interaction between ovastacin and ZP2. This is significant because any alteration in ZP2 can impact the oocyte's ability to fuse with sperm or prevent polyspermy. Additionally, changes in ovastacin activity in unfertilized oocytes may affect successful fertilization and embryo development. MiR-218-5p, miR-214-3p, miRNA-20a-5p, and miR-140-3p were identified to reduce angiogenesis, stop ovulation, and cause recurrent miscarriage. Furthermore, OPRK1, PSIP1, SMCHD1, and SOD2 genes were identified as significant genes related to recurrent implantation failure. These results can serve as effective targets for infertility treatment. Also, in silico studies suggest several medications that may be relevant to infertility; for example, VEGFA and PIK3R1 have been linked to infertility and infertility-related cancer progression. Additionally, sesamin, galangin, and coumestrol exhibited the strongest binding affinity for both VEGFA and PIK3R1 proteins. In addition, elevated levels or increased activity of tumor necrosis factor-α (TNF-α) may result in recurrent implantation failure. Consequently, it was shown that prednisone and progesterone can effectively block TNF-α. Further studies could identify additional effective treatments.

Keywords: Female infertility, In silico studies, Polyspermy, Recurrent implantation failure

The Role of AI in Personalized Ovarian Reserve Assessment and Fertility Prediction

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Abstract

Background: Ovarian reserve, defined as the quantity of primordial follicles in the ovarian cortex, is a key indicator of a woman's fertility potential. Traditional assessment methods, such as follicle-stimulating hormone (FSH) and anti-Mullerian hormone (AMH) measurements, antral follicle count (AFC), and ovarian stimulation response provide limited insights and often lack personalization, leading to variability in predictions. As fertility declines with ovarian aging, there is a growing need for precise, individualized assessments.

Methods: This study introduces a novel AI-driven model that integrates hormonal, genetic, and lifestyle data, using machine learning to produce dynamic ovarian reserve profiles. The model is employed with a large, diverse dataset of clinical and non-clinical factors, allowing it to adjust predictions based on biological markers and lifestyle variables.

Results: Our model demonstrates significant improvements in predicting ovarian reserve changes, identifying early signs of diminished ovarian reserve (DOR), and providing real-time fertility forecasts. Initial findings indicate that this AI approach increases accuracy and adaptability compared to traditional methods, offering personalized insights into reproductive health.

Conclusion: AI presents a transformative approach to ovarian reserve assessment, offering a tailored solution beyond static measures. By leveraging multi-dimensional data, the proposed model supports more accurate, individualized fertility predictions, empowering patients and clinicians to make proactive, data-informed decisions. This advancement not only enhances the predictive accuracy of ovarian health but also opens pathways for optimized fertility preservation and treatment strategies, marking a significant innovation in infertility care.

Keywords: Artificial intelligence, Diminished ovarian reserve, Fertility prediction, Personalized treatment

Artificial Intelligence in the Assessment of Female Reproductive Function Using Ultrasound: A Systematic Review

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Abstract

Background: Artificial Intelligence (AI) is changing the way medical imaging works, including ultrasound, which is commonly used to examine female reproductive health. AI has the potential to improve accuracy, reduce workload, and help with better diagnosis and treatment. This review investigated how AI is used in ultrasound to assess female reproductive function and its effectiveness, benefits, and challenges.

Methods: Several databases including PubMed, Scopus, Web of Science, and others were searched to detect studies published between 2010 and 2023. The studies included were those about using AI, such as machine learning and deep learning and those that analyzed ultrasound images for reproductive health, including ovarian function, follicle count, endometrial thickness, and uterine problems. Data were collected on the methods employed, the performance of AI models, and the challenges encountered in clinical use.

Results: In general, 25 studies that met our criteria were included. Most of the studies focused on using AI to evaluate ovarian function, especially in cases with polycystic ovary syndrome (PCOS). AI models were good at counting follicles, estimating ovarian size, and predicting ovarian health. AI also helped measure endometrial thickness and detect uterine problems like fibroids and adenomyosis. However, some challenges remain in the application of AI, such as differences in data quality, limited use across different populations, and difficulty in understanding how some AI models make decisions.

Conclusion: AI shows great promise for improving ultrasound assessments of female reproductive health by making them more accurate and efficient. However, to use AI in everyday clinical practice, larger studies, better data quality, and solutions to technical and regulatory challenges are required. Future research should focus on improving AI models and finding ways to combine them with other tools for better care.

Keywords: Advancements, Artificial intelligence, Deep learning, Reproductive medicine, Systematic review

Is Artificial Intelligence Useful in Diagnosis and Treatment of Infertility?

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Abstract

Introduction: Today, there are different types of methods used to treat infertile couples. Artificial intelligence (AI), as one of the new technologies, has played an important role in identifying and treating infertility. Using artificial intelligence, doctors can adopt the most appropriate treatment for infertile couples. The purpose of this study was to investigate the use and application of artificial intelligence in the diagnosis and treatment of infertility.

Methods: A comprehensive search was conducted in electronic databases such as Google Scholar, PubMed, ScienceDirect, Web of Science, and Scopus without time limit. The inclusion criteria of the studies were researches that investigated the use of artificial intelligence in the diagnosis and treatment of infertility. Among the studies obtained from the search, the full text of the relevant studies was examined. Finally, 24 articles were selected.

Results: The findings of the studies related to the applications of artificial intelligence in infertility were classified into four main categories. The first category was medical data analysis. AI algorithms can evaluate data from infertile couples and recognize patterns that lead to infertility. Predicting treatment outcomes was the second category. Using predictive models, AI can estimate which treatment methods are most likely to succeed for a specific patient. Personalized treatment was the third category. Based on the information obtained from the analyses, physicians can personalize treatments for each patient. This means each patient receives a treatment that is most likely to be effective for them. The last category was discovering hidden relationships. AI can uncover complex relationships that may not be directly visible.

Conclusion: Due to the high costs of performing some assisted reproductive methods, couples may suffer a heavy psychological burden if the desired result is not achieved. The use of artificial intelligence helps doctors make better decisions and provide treatments that help patients more efficiently.

Keywords: Artificial intelligence, Assisted reproductive technology, Infertility

Artificial Intelligence Can Play an Important Role in Assisted Reproductive Treatment

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Abstract

In vitro fertilization (IVF) has been a cornerstone of fertility treatment for over four decades, but its success rate has remained stagnant around 30% for the last ten years. There is the potential for advancements in this field and artificial intelligence (AI) is being seen as a promising tool to enhance IVF results. AI is being explored across multiple facets of the IVF process such as Gamete Selection, Embryo Selection, and Treatment Regimen Optimization. Despite numerous advances in IVF techniques, several challenges persist such as subjective assessments, limited predictive power, and time-consuming decision-making. The purpose of the current paper was to analyze the role of AI as an effective method in screening, predicting for infertility, and its related risk factors. For this study, three scientific repositories—PubMed, Web of Science, and Scopus—were used to gather relevant articles using the following search terms: (human infertility OR human fertility) AND risk factors AND (machine learning OR artificial intelligence OR intelligent system). Artificial intelligence represents a significant opportunity to enhance IVF success rates and streamline clinical workflows. While challenges remain, ongoing research suggests that AI could play a crucial role in improving the accuracy of gamete and embryo selection, optimizing treatment regimens, and ultimately increasing live birth rates from IVF. As the field continues to evolve, it is likely that AI will become an indispensable tool in modern reproductive medicine.

Keywords: Artificial intelligence, Assisted reproductive treatment, Embryo selection, Gamete selection, In vitro fertilization

The Use of Artificial Intelligence in Intrauterine Insemination: A Systematic Review

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Abstract

Background: Enhancing fertility via intrauterine insemination (IUI) treatment cycle has always been one of the major goals in assisted reproductive technology (ART). Considering the benefits of artificial intelligence (AI) in various fields of medicine, the purpose of this study was to investigate the use of artificial intelligence in intrauterine insemination.

Methods: The current study is a systematic review in 2024 with the steps of designing the study question, searching in the Google Scholar search engine and PubMed, Scopus, Cochrane Library, ScienceDirect, Web of Science, and SID databases. Magiran and SID were searched with keywords such as “predictive modeling”, “artificial intelligence”, “machine learning”, “intrauterine insemination”, and “infertility”. Subsequently, related studies from 2015 to 2024 were identified and selected. After screening the titles, abstracts, and full texts of 223 studies, a total of 6 studies were included. The screening of the quality of the studies was done by the Newcastle-Ottawa Scale checklist.

Results: In this study, it was found that intrauterine insemination (IUI) with the help of artificial intelligence has the specificity of 76.19% and sensitivity 66.67%, respectively, which is significantly higher than human calculations. This technology is used in the field of predicting fertility success in couples, choosing the best candidate couple for intrauterine insemination, scheduling fertilization and determining the day of ovulation, validating various tests, and determining the amount of supportive medication during intrauterine insemination treatment. The data and information obtained from 6 studies showed that the cause of infertility in men is the most important factor of fertility success during fertilization by IUI; in fact, lower sperm motility and poor sperm morphology are among the most important contributors.

Conclusion: The results of this study show that artificial intelligence is very useful in the intrauterine insemination cycle.

Keywords: Artificial intelligence, Infertility, Intrauterine insemination, Machine learning

The Role of Artificial Intelligence in Determining the HCG Trigger Time in ART Cycles

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Abstract

Introduction: The human chorionic gonadotropin (HCG) trigger timing of oocyte maturation in assisted reproductive technology (ART) should be accurate for a successful outcome. Conventional methods of determining trigger timing are based on clinical assessment and hormonal monitoring, which vary and interfere with the results. The latest development in artificial intelligence (AI) shows the possibility of improvement in the accuracy of decision making in infertility treatment by integration of complex clinical data. This narrative review discusses the role of AI in predicting and optimizing HCG trigger timing within ART cycles, with the aim of increasing the success of IVF.

Methods: A comprehensive literature search was conducted across several databases, including PubMed, Google Scholar, and Embase, to identify studies published between 2010 and 2024. The search terms used were "artificial intelligence", "HCG trigger timing", "IVF", and "ART cycles". A total of 35 studies were reviewed, focusing on AI's role in predicting HCG trigger timing. Both retrospective cohort studies and prospective trials were included, with particular attention to machine learning models optimizing oocyte retrieval outcomes.

Results: AI models significantly improved outcomes, with one study reporting a 20% increase in oocyte maturity rates when using AI to predict HCG trigger timing ($p<0.001$) compared to conventional methods. Another study showed that AI-guided cycles led to an average of 2.5 more mature oocytes ($p<0.01$) and a 12% higher fertilization rate. Additionally, patients with AI-optimized trigger timing achieved up to 15% higher implantation rates and a 10% increase in live births across multiple IVF centers.

Conclusion: Through AI, the exact timing of the HCG trigger can be determined more precisely, which results in better IVF outcomes due to the personalization of the treatment. Further clinical validation and integration into routine practice are the steps that would ensure that the technology can be used to its full potential in improving the ART success rates.

Keywords: Artificial intelligence, Assisted reproductive technology (ART), HCG trigger timing, Hormonal monitoring, In vitro fertilization (IVF), Machine learning, Oocyte maturation

The Role of Artificial Intelligence in Infertility Care: Opportunities and Challenges

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Abstract

Artificial intelligence (AI) is transforming infertility care, offering new opportunities to enhance diagnostic precision, personalize treatments, and improve patient outcomes. In reproductive medicine, AI-driven tools are being applied to refine the selection and prediction of sperm, oocytes, and embryos, creating better predictive models for in vitro fertilization (IVF) and potentially increasing the success rates for couples struggling to conceive. This review examines AI's impact on key aspects of infertility management, including patient monitoring, predictive analytics, and clinical decision support, all of which contribute to safer, more effective, and individualized treatment plans. Despite its promise, the integration of AI in infertility care is still in an early, experimental stage, presenting complex ethical and practical challenges. Ethical considerations, such as data privacy, informed consent, and the welfare of potential offspring are paramount concerns. Questions also arise regarding responsibility, as multiple parties contribute to diagnoses and treatment decisions involving AI. Additionally, fairness concerns emerge around resource allocation and cost, particularly given the high expenses associated with infertility treatments. Training for infertility specialists is essential to ensure AI tools are used responsibly and effectively. This review discusses initiatives to equip professionals with AI-related competencies while emphasizing collaboration between developers and clinicians to align AI innovations with clinical needs. The impact of AI on workflows, patient interactions, and job satisfaction was assessed, alongside patient perspectives on the acceptability of AI-based fertility treatments. Finally, this review explored regulatory and legal considerations essential for responsible AI integration, stressing the importance of transparency and quality data to mitigate risks. Overall, AI's potential in infertility care is vast, yet its success hinges on addressing ethical, social, and regulatory challenges to ensure it benefits patients and supports reproductive autonomy.

Keywords: Artificial intelligence, Challenges, Clinical decision, Ethical considerations, Infertility, Narrative review

Investigating the Challenges of Using Artificial Intelligence in Infertility Treatment: A Review

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Abstract

Background: In recent decades, significant advances have been made in the field of artificial intelligence (AI) and infertility treatment. This study examined the effects and challenges of integrating artificial intelligence into infertility treatment methods. Common methods of infertility treatment include hormone therapy, in vitro fertilization (IVF), intracytoplasmic sperm injection (ICSI), and surgery. However, AI can help improve treatment outcomes by analyzing big data and identifying complex patterns.

Methods: In this review, scientific texts were searched with the keywords of artificial intelligence, infertility treatments, and infertility challenges in Google Scholar, PubMed, Irandoc, the Scientific Information Database (SID), and Magiran.

Results: This study also dealt with the challenges related to the use of artificial intelligence (AI) in this field. These challenges include the lack of sufficient data, interpretation of algorithm results, ethical issues related to privacy and medical responsibilities, and the need to train physicians to effectively use this technology.

Conclusion: The results of this study show that although artificial intelligence (AI) has a high potential to improve infertility treatment methods, to realize this potential, existing challenges must be identified and resolved. This research can serve as a guide for researchers and medical professionals to improve infertility treatments and optimize the use of new technologies.

Keywords: Artificial intelligence, Infertility treatments, Infertility challenges

Personalized Treatment Design for Endometriosis Using Artificial Intelligence: A Systematic Review

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Abstract

Background: Endometriosis is a systemic disease that affects approximately 190 million women from birth and poses significant challenges in diagnosis and treatment. Artificial intelligence (AI) has emerged as a powerful tool for analyzing complex data and providing personalized solutions in the field of medicine. Therefore, the aim of the present study was to conduct a systematic review of existing studies on the application of AI in designing personalized treatments for endometriosis.

Methods: A review was performed independently by two people based on the PICO criteria, aligned to the research objective, and following the PRISMA checklist. The databases searched included PubMed, CINAHL, Medline, Web of Science, SID along with Google Scholar search engine, and Boolean operators. The time limit between 2019 and 2024 was determined using the MESH keywords of "artificial intelligence", "endometriosis", and "personalized medicine". After checking the inclusion and exclusion criteria and critically evaluating the quality of the selected articles, 7 articles were included in the study from a total of 38 articles.

Results: The results of the studies indicate that AI performs well in the diagnosis, prediction, treatment, and design of personalized therapies in the context of endometriosis. AI, utilizing machine learning and deep learning algorithms, is capable of identifying complex patterns in clinical and imaging data. Consequently, it can facilitate the early diagnosis of endometriosis and assist physicians in selecting the best treatment methods tailored to each patient by utilizing genomic data and biological profiling.

Conclusion: In recent decades, AI has played a significant role in managing endometriosis and can enhance diagnostic accuracy and physician decision-making, thereby preventing unnecessary or costly interventions. However, challenges remain for further utilization of AI, such as a lack of high-quality data and the need for data standardization. It is essential to note that AI serves as an assisting tool rather than a decision-maker and should never replace the decisions made by healthcare professionals.

Keywords: Artificial intelligence, Endometriosis, Personalized medicine

Comparison of the Combination of Letrozole and Clomiphene Citrate with Letrozole Alone for Ovulation Induction in Women with Polycystic Ovary Syndrome: A Systematic Review of Clinical Trials

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Abstract

Background: Polycystic ovary syndrome (PCOS) is one of the common causes of infertility caused by ovulation disorders. Clomiphene citrate and letrozole are the two main drugs for inducing ovulation in these patients. This study aimed to compare the effectiveness and safety of the combination of letrozole and clomiphene citrate compared to letrozole alone to improve pregnancy outcomes in PCOS patients.

Methods: An independent review was conducted by two people based on the PICO criteria, aligned with the research objective, and following PRISMA checklist. The databases searched included PubMed, CINAHL, Medline, Web of Science, SID, Google Scholar search engine, and Boolean operators. The time limit between 2019 and 2024 was determined using the MESH keywords of "letrozole", "clomiphene citrate", "ovulation induction", and "polycystic ovary syndrome". After checking the inclusion and exclusion criteria and critically evaluating the quality of the selected articles, a total of 7 articles were included in the study.

Results: This study investigated the effect of the combination of letrozole and clomiphene citrate compared to letrozole alone to induce ovulation. The results showed that the combination of these two drugs resulted in a higher ovulation rate and no serious side effects or multiple pregnancies were reported. This combination was introduced as a more effective and safer treatment than letrozole alone.

Conclusion: The results of this study show that the combination of letrozole and clomiphene citrate may be more effective than letrozole alone in inducing ovulation and improving the results among PCOS patients. Future studies with larger samples and long-term follow-up are recommended to definitively confirm these findings.

Keywords: Clomiphene citrate, Letrozole, Ovulation induction, Polycystic ovary syndrome

Artificial Intelligence (AI) in Infertility

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Abstract

Background: Infertility is a global problem faced by many people around the world. Infertility is not limited to just one sex, making diagnosis, follow-up, and treatment crucial. Since age is a significant factor in fertility, the golden age of infertility treatment is very important. Today, the use of artificial intelligence (AI) in infertility is an important achievement that enhances the success of these methods. In fact, AI is actually derived from the integration of computer science and knowledge using algorithms. The current study examined the role of artificial intelligence in the context of infertility.

Methods: The present study is a review study conducted to find different dimensions of artificial intelligence in the field of infertility. The criteria for selecting articles were ease of access to the full text of the articles and relevance to the aspect of artificial intelligence in infertility. The search resulted in 100 articles, 10 of which were discarded due to duplication. Twenty papers were removed due to lack of access to the full text, and eventually 70 papers were identified as suitable for study. Next, the relevant content was extracted and analyzed.

Results: In fact, AI can be seen as a scientific revolution in the new century. AI can help diagnose infertility and estimate the success rate of assisted reproductive technology (ART). AI also detects folliculogenesis, assess fetal quality, and evaluates endometrial status for embryo transfer, thereby influencing the success of assisted reproductive methods. Synthetic hormones can also be effective in checking fetal development and providing perinatal care. The evaluation of egg morphology, particularly in donated eggs, as well as the assessment of sperm morphology and semen quality, positions artificial intelligence as a significant player in the industry. Additionally, AI can be valuable in addressing idiopathic causes of infertility. Artificial intelligence can also play a very important role in the process of embryonic-placental development studies. In fact, AI is a very powerful tool that will revolutionize medicine in the coming years, including the procedure for infertility treatment and methods of assisted reproduction.

Conclusion: Due to the rapid advancement of artificial intelligence in science, especially medical sciences, artificial intelligence can be considered a window of hope for the success of infertility treatment as well as helping the birth of a healthy fetus.

Keywords: Assisted reproductive technology, Eggs, Infertility, Sperm

Systematic Investigation of Temporal Changes in Social Stigma Related to Infertility: A New Approach to Investigating Social Beliefs in Iran

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Abstract

Introduction: Society's attitude towards infertility has undergone significant changes over time. Previous studies have mainly focused on the severity of social stigma, but in this research, by adopting a new approach, the systematic investigation of temporal changes in factors affecting social stigma related to infertility has been done.

Methods: An independent review by two people based on the PICO criteria, aligned with the research objective, following PRISMA checklist was conducted. The search databases included PubMed, CINAHL, Medline, Web of Science, SID, Google Scholar, and Boolean operators. The time limit between 2018 and 2024 was determined using the MESH keywords of "social belief", "social stigma", and "infertility". After reviewing the inclusion and exclusion criteria and critically evaluating the quality of the selected articles, 6 articles that were directly related to the research topic were included in the study from a total of 38 articles.

Results: The findings show that although the intensity of social stigma related to infertility has decreased over time, the patterns of this decrease have been different by various factors affecting social stigma. Specifically, the reduction of social stigma related to cultural factors has been faster than social factors. Also, medical advances in the field of infertility treatment have significantly helped to reduce the social stigma. Quantitative results show that over the past two decades, the percentage of negative beliefs about infertile people has decreased by an average of 25%.

Conclusion: This research contributes to a deeper understanding of this phenomenon by presenting a new approach to the investigation of temporal changes in the social stigma related to infertility. The findings of this research show that although progress has been made in reducing social stigma, there are still important challenges. To further reduce this stigma, there is a need for comprehensive and multifaceted measures that include public education, social support, and health policy changes.

Keywords: Infertility, Social belief, Social stigma

Ensuring Success in Assisted Reproductive Technology and Addressing Male Infertility: A Review of the Role of Artificial Intelligence in Sperm Selection

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Abstract

Background: Semen quality assessed by sperm count and sperm cell characteristics such as morphology and motility, is considered to be the main determinant of men's reproductive health. Over the last 40 years, assisted reproductive technology (ART) has provided infertile couples with the possibility to conceive, culminating in the birth of over eight million children. Also, artificial intelligence (AI) has the potential to improve infertility diagnosis and ART outcomes estimated as pregnancy and/or live birth rate, especially in cases with recurrent ART failure. Therefore, the aim of the current research was to ensure the success of assisted reproductive technology and the elimination of male infertility.

Methods: The search was conducted according to the criteria outlined in PICO and based on the PRISMA checklist, utilizing the PubMed, Scopus, Web of Science, and Medline databases, as well as Persian databases and the Google Scholar search engine. This search covered the years 2019 to 2024 and used the keywords of "Assisted Reproductive Technologies", "Artificial Intelligence", "Infertility", and "Sperm". After reviewing the inclusion and exclusion criteria and assessing the quality of the articles, 9 out of a total of 45 articles were selected for inclusion.

Results: The results of the included studies show that artificial intelligence demonstrates a good performance in sperm detection and selection. As a result, unnecessary interventions and invasive procedures can be avoided, leading to a higher level of accuracy. Studies also show that artificial insemination using machine learning and deep learning can also lead to significantly successful results in assisted reproductive technology and male infertility treatment.

Conclusion: The diagnostic capabilities, efficiency, and reproducibility of artificial intelligence as well as its algorithms have the potential to solve the challenges of sperm selection. With the ability to process large data with high objectivity, AI has revolutionized analysis and selection of sperm in the medical field. Without artificial intelligence, the ability to store, process, and analyze large amounts of data is limited. The intersection of AI and ART is undoubtedly an emerging and valuable field of study that has the potential to reduce costs and ultimately improve clinical outcomes.

Keywords: Artificial intelligence, Assisted reproductive technologies, Infertility, Sperm

Machine Learning-Based Identification of Endometrial Receptivity Biomarkers in PCOS

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Abstract

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder that impairs endometrial receptivity and reduces the success of in vitro fertilization-embryo transfer (IVF-ET). Identifying biomarkers for endometrial receptivity disorders in PCOS patients is crucial for improving IVF outcomes. A comprehensive analysis was conducted using the GEO dataset to compare endometrial gene expression profiles between women with PCOS and those with normal ovulation. Differentially expressed genes (DEGs) were identified using the DESeq2 R package. Protein-protein interaction (PPI) networks were constructed using STRING, and network analysis was conducted with Cytoscape. The R Package facilitated the application of feature selection to filter the DEGs. Our analysis revealed several key DEGs with potential roles in endometrial receptivity. Network analysis highlighted critical nodes and interactions within the PPI network. The integration of machine learning, specifically feature selection by Recursive Feature Elimination (RFE) method, allowed for the classification of gene expression patterns with high accuracy, identifying candidate biomarkers with significant potential for clinical application. This study leverages machine learning to enhance the identification of biomarkers for endometrial receptivity disorders in PCOS patients. The identified candidate biomarkers offer promising avenues for improving diagnostic and therapeutic strategies, ultimately enhancing IVF-ET outcomes in women with PCOS. Further validation in clinical settings is warranted to confirm these findings.

Keywords: Endometrial receptivity, Machine learning, PCOS, Recursive feature elimination

Effect of Dexamethasone Plus Letrozole on Hormonal Parameters and Ovulation Induction Outcomes in Infertile Women with Polycystic Ovary Syndrome: A Randomized Clinical Trial

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Abstract

Background: Glucocorticosteroids reduce adrenal androgen production by inhibiting the production of adrenocorticotropic hormone (ACTH) through negative feedback mechanisms. Therefore, they can reduce the adverse effects of hyperandrogenism, the main problems of infertile women with polycystic ovary syndrome (PCOS). This study aimed to investigate the efficacy of dexamethasone and letrozole in ovulation, folliculogenesis, and pregnancy outcomes in PCOS patients.

Methods: This randomized clinical trial was carried out on 100 infertile women with PCOS referring to the Clinical Center of Milad Hospital in Mashhad, Iran. The patients were divided into two groups for receiving 5 mg of letrozole alone (group A) and 5 mg of letrozole plus 0.5 mg of dexamethasone (group B). The changes in serum levels of androstenedione and testosterone were compared between the two groups. SPSS software (version 22) was used to analyze the collected data. A P value < 0.05 was considered statistically significant.

Results: The obtained results of this study showed that there were no significant differences in the number of total follicles and dominant follicles, and pregnancy rate between the two groups. However, a significant difference was observed in the levels of testosterone (P=0.002) and androstenedione (P=0.003) between the two groups. Moreover, the trend in androstenedione levels differed significantly between the groups (p=0.001).

Conclusion: Overall, this study showed that dexamethasone reduces the androgens levels in PCOS patients.

Keywords: Androgen, Dexamethasone, Letrozole, Polycystic ovary syndrome

The Role of Artificial Intelligence in Managing Psychological Challenges in Infertility Treatment: A Review of Novel Applications

Hamideh Mousavi

Abstract

Despite technological advancements, infertility treatment continues to pose significant psychological challenges for patients. Feelings such as anxiety, depression, and stress not only impact patients' quality of life but also affect the success of treatment. Many patients face limited access to traditional psychological services, creating a critical gap in care. Artificial intelligence (AI), as an emerging technology, has the potential to address these challenges and enhance patients' treatment experiences. This review examined the roles and applications of AI in managing the psychological challenges associated with infertility treatment. Artificial intelligence (AI) plays several key roles in managing psychological challenges associated with infertility treatment. First, AI systems can analyze biometric and psychological data to detect early signs of anxiety and depression in patients, enabling timely interventions and reducing the risk of escalation. For stress and anxiety management, psychological chatbots, such as *Woebot*, engage patients in interactive conversations to help them manage their emotions effectively, while relaxation applications like *Calm* provide personalized exercises that alleviate stress and promote mental well-being. Additionally, AI can offer continuous psychological support during treatment by monitoring patients' emotional behaviors in real time and sending alerts to therapists for timely interventions, ensuring ongoing support throughout the process. Moreover, advanced tools utilize speech, text, and facial expression analysis to uncover hidden emotions, enhancing the quality and precision of therapeutic interventions. Finally, by integrating psychological and medical data, AI provides tailored counseling strategies that help patients cope with stress and maintain motivation during their treatment journey. The use of artificial intelligence (AI) in infertility treatment offers several advantages and limitations. Among the advantages, AI improves access to psychological services for underserved populations, reduces costs, and increases accuracy in diagnosis and treatment. Additionally, it provides personalized and continuous interventions tailored to each patient's needs. However, there are notable limitations, including concerns about data security and patient privacy. Furthermore, AI cannot fully replace the essential elements of human interaction and emotional understanding that are crucial in therapeutic settings. Finally, the effective implementation of AI requires large, high-quality datasets to train the models, which can be a significant barrier to its widespread use. AI, through its novel and data-driven tools, has the potential to effectively manage the psychological challenges associated with infertility treatment. It can significantly enhance patient experiences and improve therapeutic outcomes. However, the future of AI in this field requires further research, the development of advanced technologies, and seamless integration into healthcare systems. Interdisciplinary collaboration among physicians, psychologists, and technologists is essential to fully realize AI's potential in addressing psychological challenges in infertility care.

Keywords: Anxiety management, Artificial intelligence, Depression, Infertility treatment, Psychological challenges

The Threads of Artificial Intelligence

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Abstract

Background: Artificial intelligence (AI) is rapidly advancing, revolutionizing various aspects of human life, from healthcare and education to industries and communications. However, these advancements also bring potential threats that require careful examination and proper management. This article aimed to explore the main risks associated with the development and use of AI and proposed strategies to mitigate these threats.

Methods: This study reviewed articles and credible international reports on the threats posed by AI. Data were extracted from scientific sources and relevant databases and analyzed qualitatively. The examined topics included security, ethical, social, and economic threats.

Results: This study reviewed articles and credible international reports on the threats posed by artificial intelligence (AI), extracting data from scientific sources and relevant databases for qualitative analysis. The findings identified four main categories of AI threats: security, social, ethical, and economic. In terms of security, threats include the misuse of AI for cyberattacks, the generation of fake content, and the development of autonomous weapons, which pose significant global risks. Socially, AI contributes to increased inequality and unemployment through job displacement, manipulation of public opinion, and expanded surveillance. Ethical concerns arise from algorithmic biases that lead to discriminatory decision-making and a weakening of human ethical principles due to overreliance on AI. Economically, the monopolization of markets by major tech corporations and potential financial crises stemming from AI algorithm errors threaten stability. Additional threats include lack of transparency and accountability in AI systems, which diminishes trust and reduces human control over critical decisions, as well as extensive violations of data privacy. These findings underscore the urgent need for robust regulations, international oversight, and heightened public awareness to effectively address the multifaceted threats posed by AI.

Conclusion: Although AI offers numerous opportunities to improve human life, it can pose significant risks without proper management. Developing international regulations, raising public awareness about AI, and enhancing transparency in algorithm development are essential steps to mitigate these challenges.

Keywords: Algorithm development, Artificial intelligence, Policy making, Security, Threads

Ethical and Legal Challenges of Application of Artificial Intelligence in Healthcare Systems

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Abstract

Background: Artificial intelligence (AI), as a transformative technology, is rapidly expanding across various industries, particularly in healthcare and medical fields. This technology holds vast potential in areas such as disease diagnosis, improving the quality of medical services, and data analysis. However, the use of AI in healthcare systems is accompanied by significant ethical and legal challenges, which require careful examination and appropriate policymaking. The aim of this study was to explore the ethical and legal challenges associated with the application of artificial intelligence in healthcare systems.

Methods: This research is based on a review of credible sources related to AI in healthcare. The study identified and analyzed the ethical challenges related to this technology and examined solutions for enhancing its safety and effectiveness in healthcare systems.

Results: Despite the significant benefits of AI, several ethical and legal challenges arise. The first challenge is trust in artificial intelligence. Some individuals hold negative perceptions and believe that AI will not be able to fully replace doctors. Trust in AI-powered healthcare centers requires transparency in processes and providing accurate information to the public. If society cannot trust the decisions made by these systems, the consequences could lead to a decrease in the quality of healthcare services. Violation of human dignity is the second concern. Respecting human dignity and the free choice of individuals in using personal data is another major challenge. The use of AI might lead to the violation of individuals' privacy, and their choices could be influenced by algorithms. Therefore, there is a need for policies and regulations to protect the rights and dignity of patients. The third concern is respect for individual autonomy. Respecting the principle of individual autonomy in making medical decisions is another ethical challenge related to AI. Patients should be able to make decisions about how their health data is used and be informed about the purpose for which their information is being utilized. Transparency in this area is crucial to support patient rights. The fourth concern is AI and diagnosis/treatment. While AI models can assist in data analysis, the lack of deep understanding of a patient's specific condition and human emotions may lead to incorrect decisions. This becomes particularly problematic when there is insufficient data on rare diseases. The last challenge is cybersecurity and data privacy violations. With the increasing prevalence of digital medical data, significant cybersecurity risks arise. The theft of patient data and the misuse of this information can have serious implications for individuals'

privacy and public security. Therefore, meticulous record-keeping and the implementation of security protocols should be priorities for healthcare systems.

Conclusion: Given the multiple benefits and challenges of AI in healthcare, it is essential for policymakers and public health officials to take measures to establish regulations and standards for the safe and ethical use of this technology. Ensuring transparency in AI processes, protecting patient data, and building public trust in this technology are effective strategies. In this way, the capabilities of AI can be leveraged to improve the quality of healthcare services while preserving the rights and dignity of patients. Ongoing research and development in AI, as well as community education and awareness about this technology can help improve its acceptance and effectiveness in healthcare systems. By ensuring a harmonious relationship between new technologies and human needs, a positive and effective healthcare system can be created, where the rights and dignity of individuals are preserved.

Keywords: Artificial intelligence, Diagnosis, Ethical and legal challenges, Healthcare systems, Human dignity, Transformative technology, Treatment

Introduction to Artificial Intelligence

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Abstract

Background: Artificial intelligence (AI) was first used by John McCarthy in 1956, who defined it as "the science and engineering of making intelligent machines." Artificial intelligence refers to the simulation of human intelligence processes by computer programs, which have the ability to think. The goal of AI is based on three pillars: 1) learning, 2) reasoning, and 3) understanding. Since AI aims to imitate human behavior, the extent to which an intelligent system can replicate human abilities serves as a criterion for categorizing types of AI. The purpose of the current article was examining the concept of artificial intelligence and its impacts on daily life and various industries.

Methods: This research is based on a comprehensive review of scientific sources related to AI.

Results: Research findings indicate that artificial intelligence can contribute to improving efficiency and reducing costs in various fields, including healthcare (improving patient treatment outcomes, lowering costs, rapid diagnosis and treatment, and providing solutions), manufacturing (performing complex tasks with high precision and speed), education (personalizing the learning process), security (facial recognition systems and video surveillance), data analysis, and business. Branches of artificial intelligence include expert systems, robotics, machine learning, neural networks, and natural learning processing (NLP). Expert systems are computers designed to assist data scientists in interpreting data. These systems are considered early, simple examples of knowledge-based technology. The field of robotics focuses on the creation of robots capable of performing various tasks with high precision and speed. AI algorithms help robots better interact with their environment. Machine learning allows for the use of patterns and inferences from data without the need for specific instructions. Machines can improve themselves by analyzing past data and receive training on specific topics. Neural networks have structures similar to biological neural networks and are designed to process data and learn from it. They can identify and analyze complex patterns. Natural language processing (NLP) branch focuses on the interaction between humans and machines using natural language. Its main goal is to understand and analyze human language and create more effective relationships between humans and machines. By using these methods, AI can be applied across industries to automate processes, provide more accurate analyses, and make faster decisions. For example, NLP systems enable better interaction between humans and machines. Additionally, the use of AI algorithms in data analysis helps companies and organizations make better decisions.

Conclusion: Despite its numerous benefits, artificial intelligence comes with challenges, such as the need for significant resources and issues related to data bias. The development of AI must be done with care and responsibility to avoid its negative consequences. Overall, AI holds great potential for transforming human life and society. Ongoing research and advancements in this field not only help improve quality of life, but also enable us to address major global challenges with innovative and creative approaches. On the other hand, AI must be developed responsibly, taking ethics into consideration. Laws and regulations must be established to prevent the misuse and unethical application of this technology.

Keywords: Artificial intelligence, Intelligent machines, Machine learning, Natural language processing, Neural networks

The Use of Artificial Intelligence in Nursing, Midwifery, and Infertility Care

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Abstract

Background: The integration of artificial intelligence (AI) in healthcare has revolutionized clinical practices, particularly in nursing, midwifery, and infertility care. AI applications in these fields have demonstrated the potential for improving patient outcomes, optimizing resource use, and enhancing clinical decision-making. This study aimed to investigate the current and emerging roles of AI in these domains and evaluate its impact on care quality and delivery.

Methods: A scoping review was conducted, focusing on studies published between 2015 and 2024. The search was performed in PubMed, Scopus, and CINAHL using keywords such as "artificial intelligence," "nursing," "midwifery," and "infertility care." Articles that explored empirical evidence, reviews, or case studies on AI applications in these areas were included. Data analysis involved thematic synthesis to identify key trends and innovations.

Results: The review identified significant advancements in the use of AI across the three areas. In nursing, AI technologies such as predictive analytics for patient deterioration and virtual health assistants have improved care delivery and patient safety. In midwifery, AI-driven tools have been employed for prenatal risk assessments, including predicting complications such as preeclampsia and preterm labor, contributing to timely and effective interventions. In infertility care, AI applications such as embryo selection algorithms and predictive models for treatment outcomes have enhanced the precision of assisted reproductive technologies, leading to improved success rates. However, challenges including ethical considerations, data privacy issues, and the need for healthcare professionals to adapt to AI systems were also highlighted.

Conclusion: AI offers transformative opportunities in nursing, midwifery, and infertility care, significantly enhancing clinical outcomes, personalization, and efficiency. Addressing ethical, technical, and practical challenges is essential for the effective integration of AI into these fields. Further research should focus on optimizing AI tools and ensuring they align with patient-centered care principles.

Keywords: Artificial intelligence, Ethical challenges, Infertility care, Midwifery, Nursing, Personalization

Artificial Intelligence in the Treatment of Infertility: A Review of Advancements Over the Last Decade

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Abstract

Infertility is a global health issue affecting women and men of reproductive age with increasing incidence worldwide, in part due to greater awareness and better diagnosis. Artificial intelligence (AI) has the potential to improve infertility diagnosis and outcomes in assisted reproductive technology (ART), particularly for individuals experiencing recurrent ART failures, as measured by pregnancy and live birth rates. Artificial intelligence methods can be utilized to improve the selection and prediction of sperm cells, oocytes, and embryos and to generate better predictive models for in vitro fertilization (IVF). Implementing AI algorithms into the IVF laboratory allows for reliable, objective, and timely assessments of both clinical parameters and microscopy images. As evidenced by the consensus of a group of fertility experts, properly developed AI algorithms have the potential to assist practitioners from around the globe to standardize, automate, and improve IVF outcomes for the benefit of patients. However, collaboration between AI developers and healthcare professionals is the key factor for such a purpose and in making the plan possible.

Keywords: Artificial intelligence, Assisted reproductive technology, Infertility, In vitro fertilization

Panberes

پنبه‌ریز با بیش از سه دهه تجربه در تولید محصولات بهداشتی، همواره در زمینه تأمین سلامت و آسایش زنان و دختران ایرانی پیشگام بوده است. این برند با ارائه محصولاتی متنوع مانند نوار بهداشتی، پد روزانه، چسب زخم و گوش پاک‌کن، تلاش دارد تا نیازهای بهداشتی جامعه را به بهترین شکل ممکن برآورده کند.

ژل بهداشتی بانوان

در ادامه تعهد همیشگی پنبه‌ریز به سلامت و آسایش زنان، ژل بهداشتی بانوان پنبه‌ریز به‌عنوان محصول جدید و نوآورانه این برند معرفی شده است تا با ویژگی‌های منحصربه‌فرد، تجربه‌ای تازه در ارتقاء بهداشت شخصی را به ارمغان آورد.

ویژگی‌های منحصربه‌فرد این محصول عبارتند از:

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- ایجاد شادابی و کنترل بوی نامطبوع
- حفظ نرمی و رطوبت ناحیه تناسلی
- پیشگیری از سوزش و خارش
- خاصیت ضدالتهابی برای کاهش تحریکات پوستی
- ایجاد حس خنکی، تازگی و طراوت
- فاقد SLS، SLES، پارابن، الکل و صابون

ژل بهداشتی بانوان پنبه‌ریز با ترکیبات طبیعی، ملایم و تقویت‌کننده، در دو فرمولاسیون ویژه برای پوست‌های حساس و نرمال طراحی شده است تا سلامت و لطافت را به بهترین شکل ممکن حفظ کند

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۲- لطیف ضخیم بزرگ
مناسب برای خونریزی زیاد_لایه رویی: نانوون (نرم و لطیف)_تعداد قطره: ٦
۳- لطیف نازک بزرگ
مناسب برای خونریزی زیاد_لایه رویی: نانوون (نرم و لطیف) _تعداد قطره: ٥

محافظت کامل برای روزهای پرتحرک (نوار بهداشتی‌های روزانه)

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۲-روزانه ضخیم بزرگ
مناسب برای خونریزی زیاد_لایه رویی: مشبک_تعداد قطره: ٦
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مناسب برای خونریزی خیلی زیاد_لایه رویی: مشبک ویژه_تعداد قطره: ٦
۲-شبانه نازک بزرگ
مناسب برای خونریزی خیلی زیاد_لایه رویی: مشبک ویژه _تعداد قطره: ٦

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مناسب برای پوست های حساس_تعداد قطره: ۷
لایه رویی: نانوون (نرم و لطیف) _استفاده شده از لایه ایرلید
قدرت جذب: فوق العاده (در مقایسه با نوارهای بهداشتی از جنس ایرلید)
۳-دایموند بزرگ شبانه ٤-دایموند خیلی خیلی بزرگ شبانه
مناسب برای پوست های حساس_تعداد قطره: ۷
لایه رویی: مشبک ویژه_استفاده شده از لایه ایرلید
قدرت جذب: فوق العاده (در مقایسه با نوارهای بهداشتی از جنس ایرلید)

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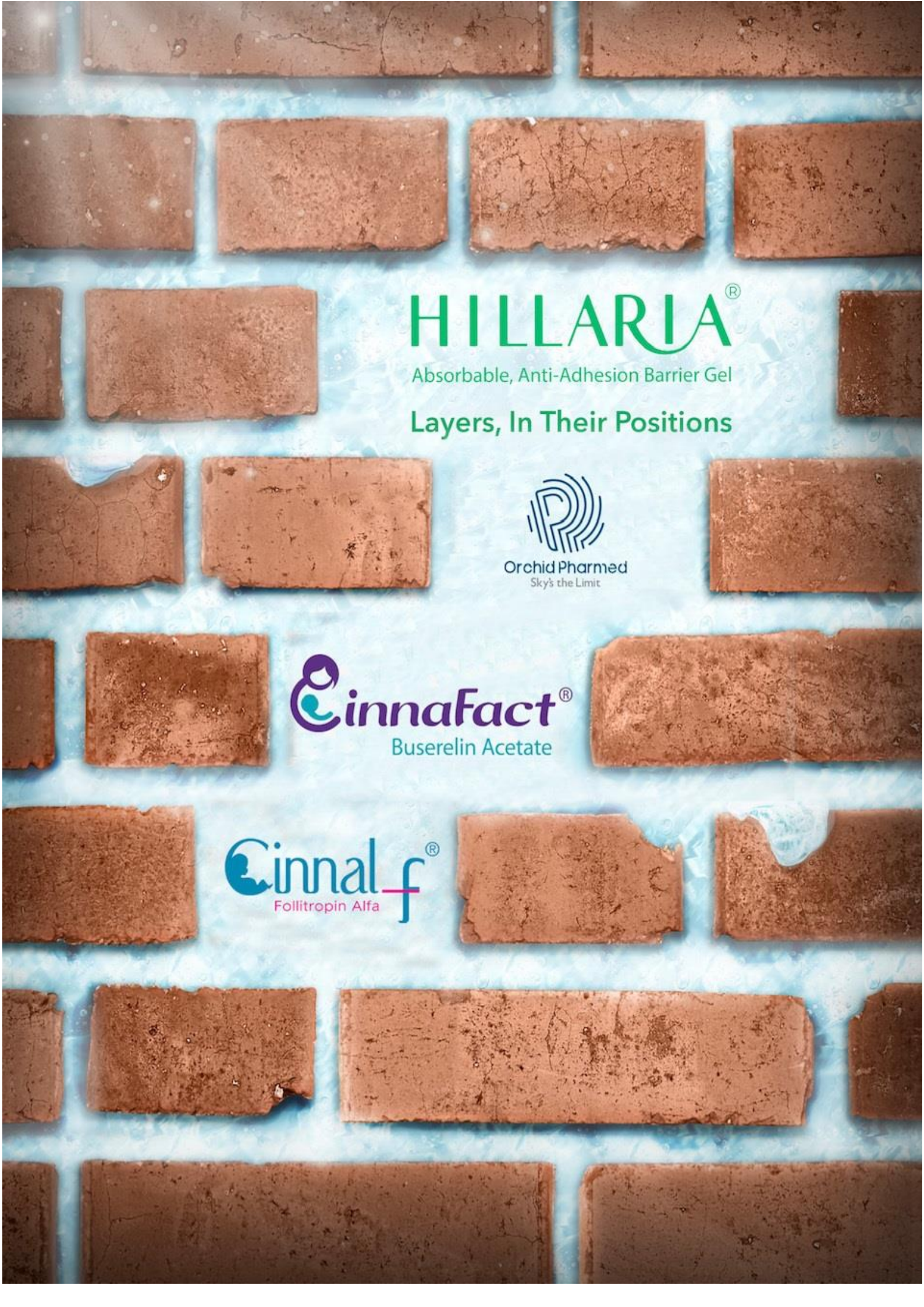
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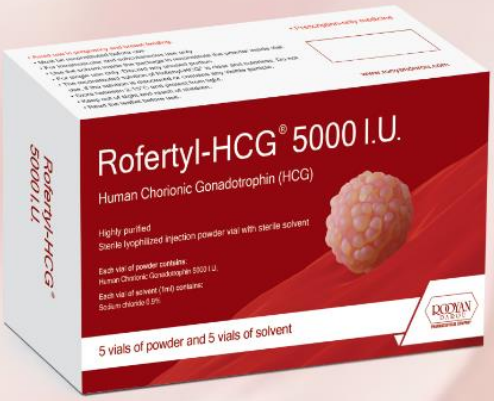

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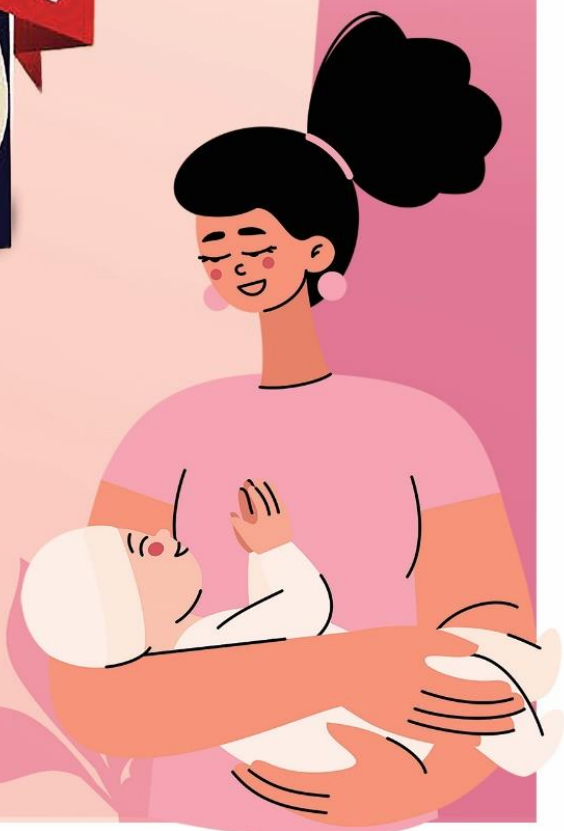

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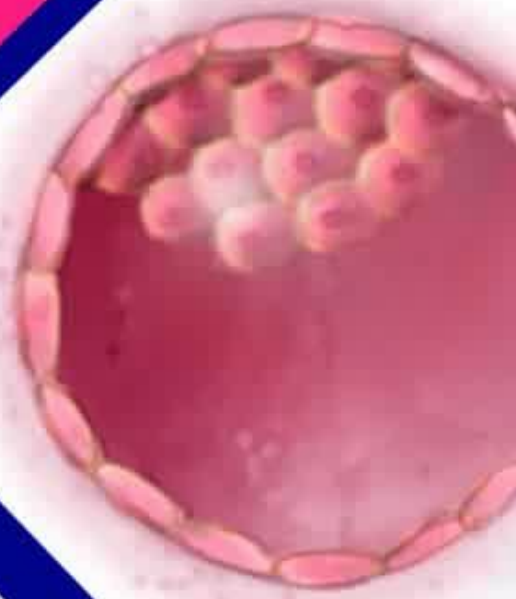

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محورها:

۱- جایگاه PGT-A و روشهای غیر تهاجمی جایگزین آن
۲- جایگاه و نقش مشاوره جنین شناسی در درمان زوج نابارور
۳- باروری و آلودگیهای محیطی
۴- مسائل اخلاقی و حقوقی در بخش جنین شناسی
۵- روشهای نوین از دیدگاه جنین شناسی در درمان ناباروری

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