Innovative use of artificial intelligence in urogynecology

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Development of artificial intelligence (AI) has become a worldwide priority in many fields. AI consists in the use of complex algorithms in order for machines to reason and perform cognitive functions, including problem-solving, outcome prediction, and decision-making. In obstetrics and gynecology, some innovative advances have been published with varying success, including automated fetal intrapartum surveillance reading, as well as in vitro fertilization success prediction tools and embryo selection models [1]. Urogynecology, in particular, will benefit greatly from future developments in AI.

First, developments in AI are enabling advances in telemedicine. Through the use of wearable devices linked to AI systems, patients' conditions could be monitored, tracked, and managed virtually. Currently, electronic medical records software automates scheduling between caregivers, organizes care plans, creates alerts for follow-ups, and automates billing, as well as portals for patients and families. Telemedicine use is also increasing through paid applications that can be linked with electronic medical records, and could be further tailored to the urogynecological aging population. Virtual visits allow for follow-ups that do not require a physical examination, and can shorten wait times while avoiding transportation difficulties for those patients living afar or with limited mobility. Telemedicine in urogynecology could exploit the use of wearable devices, such as those monitoring for urinary incontinence (which could be more precise than bladder diaries), and post-void residual bladder volume scanners. Wearable devices monitoring bladder volumes have recently been

developed for use in pediatric populations with nocturnal enuresis and other types of urinary incontinence [2]. Treating teams could remotely access collected data to manage patients, or ultimately, this could be done by an AI system.

Another extremely valuable application of AI in urogynecology would involve complex management algorithms, to help patients and providers to navigate through available options and predict response to treatment for women with various pelvic floor disorders. The counseling role of urogynecologists, gynecologists, and female urologists is complicated by the fact that multiple pathological conditions of the pelvic floor frequently co-exist, and a series of patient factors can impact outcomes. Despite these limitations, randomized controlled trials (RCT) results are frequently cited to patients during counseling as the only available estimate of outcomes. Recently, female pelvic reconstructive surgery management algorithms have been developed. For example, Jelovsek et al.'s algorithm predicts the risk of de novo stress urinary incontinence after prolapse surgery [3]. However, the algorithm, based on RCT data, was found to have limited external generalizability, as demonstrated by the lack of improvement in patient satisfaction, with the decision to place a mid-urethral sling when women were randomized to using the algorithm versus not [4], and limited predictive value when used as predictive diagnostic test [5]. A more recent algorithm, also developed by Jelovsek et al., and based on RCT data, estimates risk of recurrence, complications, and health outcomes after prolapse repair [6]. Optimally, in the future, an all-encompassing algorithm would be developed to propose complete patient-centered solutions tailored to each woman's characteristics, symptomatology, and expected goals for outcomes. AI could exploit big data, including patient-reported outcomes, to allow the development of such an algorithm.

Intrinsic and extrinsic challenges affect the progress and usability of AI in urogynecology, as well as in medicine overall, including new knowledge needed to be acquired, new types of errors that can occur (including the algorithm not predicting the outcome appropriately), confidentiality and ethical issues, the matter of intellectual property, as well as the

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expensive funding required to develop those technologies. Development of guidelines for regulatory approval of algorithms prior to widespread adoption could protect both patients and physicians [7].

Artificial intelligence will likely occupy a pivotal role in the future of female pelvic medicine and reconstructive surgery, and will no doubt evolve rapidly. Care providers will have to learn to introduce these new tools into practice, while maintaining a human, caring approach to patient care.

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