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Artificial Intelligence - Changing the Field of Prostate Cancer?

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Dear Sir,

Artificial intelligence (AI) is the simulation of human qualities such as reasoning, learning, problem solving, understanding language and processing of visual information by machines.

Prostate cancer affects 1 in 8 men and is the 3rd most common cause of cancer related mortality. The developing role of AI in prostate cancer is a clear example of how practice is changing.

The diagnosis is made by a pathological evaluation of a prostate biopsy. Recent European guidelines have changed to recommend men undergo an MRI (mpMRI) prior to biopsy. Following mpMRI men undergo a systematic +/- targeted biopsy.

AI may become a diagnostic aid in radiology- utilising radiomic features, AI algorithms have been trained to detect prostate cancer or to predict Gleason scores. Algohary et al., compared the AI algorithms to the universally used Prostate Imaging Reporting and Data System (PI-RADS). They showed that the AI models yielded overall accuracy improvement of up to 80% and 60% for MRI-negative-biopsy-positive and MRI-positive-biopsy-negative patients, respectively.[1]

Kwak et al., introduced an AI algorithm to detect prostate cancer on digitized pathology images. Utilizing specimen images, the algorithm achieved > 97% accuracy in detecting prostate cancer.[2] Digital pathology, using image processing, analysis and interpretation of digitized images could enable automated and standardised pathology diagnosis.

AI has the potential to be used as a screening tool for both radiologists and pathologists- if AI can screen out the 'normal' studies and slides, then the clinician can focus their valuable time on the interpretation of abnormal results which are ultimately what determines a patient's course.

Andras et al, have recently reported how the combination of robotics and AI is the future of surgery.[3] Firstly, using an AI approach- surgical times can be more accurately estimated to ensure optimal use of an operating list- especially important in a service like ours with considerable waiting lists. A model to predict case duration was developed for robotic surgery including 28 factors related to the patient (e.g., age, obesity, malignancy, tumor location, and comorbidities), to the procedure type, as well as to the robotic system model and the expertise of the table-side assistant.

AI systems can assist surgeons by improving the visualisation of the intraoperative anatomy. When augmented reality overlay such as 3D reconstruction of the surgical target are accurately positioned over the patient anatomy, it enhances the interpretation of surgical field- akin to a "GPS-like" surgical navigation.[4]

As AI is in its infancy, we are probably seeing two effects in the published literature. The Pareto Principle AKA the 80/20 rule; in that 20% of effort has resulted in 80% of results. The last 20%, to get us effective clinical solutions will likely require a much larger and harder effort. Secondly- the lack of generalisability. Currently published algorithms, especially in medical imaging, often underperform when removed from their carefully curated data environment.

There will always be a need for the clinician but AI has the potential to augment their skills to improve the uniformity of outcome for the patient.

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