Editorial

Could artificial intelligence help in the risk stratification of thyroid nodules?

Thyroid nodules are very common in India, while thyroid cancer is relatively rarer.[1] Hence, when a physician encounters a thyroid nodule, the main challenge is to determine whether the nodule is malignant, or has the potential to be malignant. Ultrasound imaging, followed by an ultrasound-guided fine-needle aspiration cytology is the standard tool for risk stratification, classification, and decision on thyroid surgery.[2]

However, current classification systems do have the limitation of being subjective; there is significant intra- as well as inter-observer variability. As a result, there are differences between advisories from various guidelines.[3] Certain thyroid cancers could have a benign appearance on sonograms, while certain benign nodules could give false-positive diagnoses of thyroid malignancy. While the aim of the diagnostic approach is to prevent unnecessary invasive procedures like surgery, currently, there is a need for better tools. To add to this, there is the issue that thyroid cancers may be overdiagnosed in India.[4]

Could artificial intelligence (AI) provide a solution? AI is commonly defined as intelligence displayed by machines, in an effort to mimic human intelligence. AI has emerged as an important tool in healthcare, and has been researched to aid physicians in the management of illnesses such as cancer and diabetes.[5,6] This impact of AI is especially important in the area of pattern recognition and medical imaging, where the use of deep learning through AI may remove the subjective nature of image interpretation. An example is the use of a device attached to a smartphone, which can peer into the retina, examine retinal images and diagnose "referable" diabetic retinopathy.[7] Given that the early diagnosis of thyroid nodule is largely dependent on thyroid ultrasound (which essentially generates a radiological image), could AI be used effectively to reduce the number of thyroid surgeries?

Recently, a new AI model, called AIBx, was developed for better diagnosis of thyroid nodules.[8] The unique nature of this algorithm was that it requires a physician's input. The researchers studied ultrasound images of 482 thyroid nodules from patients who underwent either biopsy or thyroid surgery at their hospital. In case the nodules gave no clear diagnosis of either benign or malignant, those nodules were excluded. Thus, ultrasound images which were proven to be clearly benign or malignant were inputted into software to develop a diagnostic system.

Subsequently, the authors proceeded to test their system on a prospective basis with 103 thyroid nodules. Briefly, the physician could take the ultrasound picture of the thyroid nodule and process it through the algorithm. This would then give the physician a set of images with similar features, along with the eventual diagnosis of that particular and similar set. Thus empowered with the ultrasound features, and the AI-enabled information about the diagnosis from similar images, the physician could then choose to put down the diagnosis. Their results of this AI system were validated against the final diagnosis of the nodule. The results were impressive, with a negative predictive value of 93.2%. The rest of the results were as follows: sensitivity - 87.8%, specificity - 78.5%, positive predictive value - 65%, and accuracy - 81.5%. The authors reported that this AI system's performance is similar to the classification of the American Thyroid Association as well as the ACR-TIRADS system. The researchers postulated that this image similarity AI mode would empower the physician to give more confidence in the predictions, reduce subjectivity, and decrease the number of unnecessary biopsies.

These are early days in this research. Currently, at best, this system could be used as a decision support tool for the experienced physician, to improve the efficiency of an ultrasound-based diagnosis of thyroid nodules. It could also have an important value in the training doctors, as they would have multiple images to look at for improving their horizons as far as thyroid ultrasound-based diagnosis is concerned. There are some limitations with research on this new system: the small sample size and the possibility of selection bias. Finally, this system still needs to be tested against the accuracy of the present classification system, focusing on outcomes such as the avoidance of unnecessarily invasive procedures for the thyroid nodule. Could this AIBx system help in triaging out the low-risk nodules, and hence that physicians could focus on the thyroid nodules with higher-risk features? At present, this system is unlikely to fast-tracked into routine practice without more data.

However, there is no doubt that this research is innovative, and that this use of AI could be a harbinger of the times to come. In future, this form of AI could be improved further by adding feedback from histopathology to the algorithm. Moreover, this particular AI system may improve with time. When more and more high quality data – clinical, histopathological, biochemical, genomic, radiological and others, in appropriate quantities – are inputted into the system, the AI-based systems in general are likely to perform even better.

This research brings into focus two unique aspects of medical diagnosis, where AI could have a role to play. The first is the doctor's memory. Even the most intelligent of doctors, whether they are physicians or radiologists, may not be able to rightly claim that they remember every detail of every clinical image that they have had access to. By supplying a set of thyroid ultrasound images with diagnosis (images similar to the one they are currently encountering), the physician could have access to different patterns of similar images, and the diagnosis of those images. Simply put, the AI is saying: From this system's set of images, this looks like a benign nodule (or a malignant nodule, as the case may be). This would help the physician to a better diagnosis by extending the physician's memory and pattern recognition base. Thus, AI could extend our clinical memory as physicians.

Second, perhaps, more important is the philosophical angle that stems from this research. Will AI take over the job of a physician? However, presently, as shown in this research, rather than replacing the physician's task, AI is likelier to be a tool assisting the clinician by offering a direction for better diagnosis and therapy. Clinical skills, current investigation modalities, and experience continue to be quintessential, as far as thyroid nodule management is concerned. Not just in thyroid management, AI is rapidly entering other aspects of medical care too. However, ideally, AI must be customized to the needs of individual countries and regions so that it may be of use to the physicians.[9] Is a good clinician empowered with tools of AI a better decision-maker than a good clinician without access to AI? Time will tell.

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