Application of Artificial Intelligence in Vascular Surgery

Sana Sharafat Ali[1], Syeda Kiran Riaz[2] and Tanwir Khaliq[3]

[1]Department of General Surgery, Pakistan Institute of Medical Sciences, Hospital, Islamabad, Pakistan
[2]Department of Molecular Biology, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan
[3]Department of Surgery, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan

Properties of human intelligence are exhibited by a broad discipline, focussed to design systems, named Artificial intelligence (AI) that has found applicable in many walks of life. The role of AI in medicine is still in its infancy. It is needed to instigate the primordial perception of AI and its potential applications in vascular surgery too.[1] Imaging in vascular surgery is a fundamental step in the management of patients. Confirmation of the diagnosis, evaluation of the prognosis, and the decision regarding the surgical intervention is being enabled by imaging. High divarication of morphology, size, and curvature is being revealed by vessels, that's why vascular segmentation is very demanding. Image segmentation and pattern recognition can be refined with the help of AI techniques. Machine learning can also be used for the detection and measurement of vascular calcifications from CTA images. New tools are needed to evolve to help surgeons to better gauge the therapeutic approach. Patients who need auxiliary care can also benefit with the use of AI.

The treatment of vascular diseases can be facilitated by AI-aided detection, diagnosis, and interpretation. A vigorous clinical decision-support framework can be emerged with the use of Computed Tomography Angiography (CTA) and Magnetic Resonance Angiography (MRA) imaging that can be explicated by AI tactics. The location of occlusive /stenotic lesion, length and degree of stenosis, plaque characteristics, development of collaterals, inflow vessels, and the distal run off can be detected by AI for Peripheral Arterial Occlusive Diseases (PAOD) and carotid artery stenosis. The degree of calcification, hemodynamically significant stenosis, and presence of atherosclerosis can also be signaled by AI.

For Aortic aneurysms as well as for peripheral aneurysms, AI can be used to manifest the location of the aneurysm, dimensions of the aneurysm, centerline tracing, lumen segmentation, proximal sealing zone, distal sealing zone, presence of collateral, thrombus load in the aneurysm, distance from the renal arteries, distance from the aortic bifurcation, presence of patent lumbar and inferior mesenteric arteries, calcification and tortuosity of femoral vessels and atherosclerosis calcification of the access vessels for endovascular approach.

Correspondence to: Prof. Tanwir Khaliq, Department of Surgery, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan
E-mail: ktanwir@hotmail.com

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Artificial Intelligence (AI) requires a range of mechanics and information genesis. Image analysis and diagnosis have been effectively intensified using Artificial Intelligence.[2-5] Identification, diagnoses, and planning of patient treatment can be helped by the clinicians with the illustrations of the lesions that can be precisely selected. The field of vascular surgery can be assisted by Computer-aided Diagnosis (CAD) and clinical decision support systems.[5-7] Lately, Computer-aided diagnosis (CAD) has become an emerging area of inquisition. For CAD, input from the field of Radiology is crucial.[8]

AI models need to be skilled with the help of image biobank, to devise an obligatory foundation to organise the image data. AI can be used as an upgraded tool in determining a customized patient's protocol.[3,4,8] The data-driven approach therefore attained, is clearly superior.[3-5,9] The synchronism of CAD research and imaging instruments will be emerged over a period of time with opportunities.[10-13]

By the imaging techniques with modern evaluation in relation to the community image biobank, Artificial Intelligence is a recommended linking tool between the clinician and the patient.[3,4] Researchers and professionals in the particular fields are required to have multidisciplinary approach.[3-5] Concomitantly, future research in medicine and in selected areas of computer science can remarkably be influenced by the new contribution opportunities.

The methodical implementation, prompt reading time, and harmonious workflow integration are the benefits provided by CAD to the health care system. The development in medical imaging technology subscribed to the early detection and diagnosis of vascular disease. The selection of patients in whom surgery is being offered has endured the most demanding tasks in the management of vascular disease.[6-8] Angiography gives an information regarding the exact location of the stenosis in peripheral vascular disease, however, the assessment of hemodynamic stenosis, can be done by the new techniques reinforced by AI.[13]

The advantage of AI includes the reduction in human error as the computers are programmed properly. They do not make mistakes and decisions are made from previously gathered information by applying certain algorithms so it will reduce errors and will help achieving greater precision in interpreting the CTA. AI availability is ensured 24 hours as a human can work

for 6 to 8 hours in a shift efficiently and the machines programmed properly can give results 24/7 without any signs of exhaustion. In our setup, it adds to the precision of the decision making hence standardizing the tasks and improves the output. It also reduces the need of human resource as it is digital assistance hence making the task more cost-effective with time and reduces the dependence on humans.

By using AI, one can take decisions faster as compared to humans as the former may get biased by analyzing factors emotionally and practically but the machines interpret what they are programmed so it will improve the results faster. Like using other applications in daily routine as in mobiles, tablets, laptops and computers if this app for vascular interpretation can be developed it will revolutionize the field in a standardized way. AI is backing new inventions in almost every field and it helps humans in solving complex problems in a standard way so it can be a milestone in the field of vascular surgery as well.

As any technology has a bright side it would have had some shortcomings or negative aspects. AI needs updating of machineries, softwares and hardwares time to time hence increasing the cost of its making and maintenance. As the majority of the applications make the tasks automated, it is going to make humans more dependent on them. By replacing most of the tasks done by humans it will create unemployment in the future.

AI robots or programs do not have the quality of critical thinking although they work more efficiently but making a multidisciplinary team decision is definitely deficient.

Machine lacks out of box thinking as they gather and interpret data which has been programmed in them so if any other task is assigned, they will start giving errors.

Everything has advantages and disadvantages so does AI. Every invention would have positive and negative impacts, but we need to use the positive side of the idea to make the world better. AI has great potential. We should get the advantage of the power of AI in vascular surgery and radiology interpretation to have better outcomes and to train the next generation in a standardised way keeping in view the betterment of the patient.

Reduced morbidity and mortality will be led by AI support in vascular surgery, therefore, preventing disability and dependency statuses in society.[12] The grid of better patient management will be upraised by the incorporation of AI to our current Vascular Surgery facility. The reliability of the health care facility will also be heightened. Convalescent adjustability to the newer technology from the beginning will be an important breakthrough in the training of young surgeons.[4-8]

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