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AN OVERVIEW: AI TOOLS USED IN CANCER

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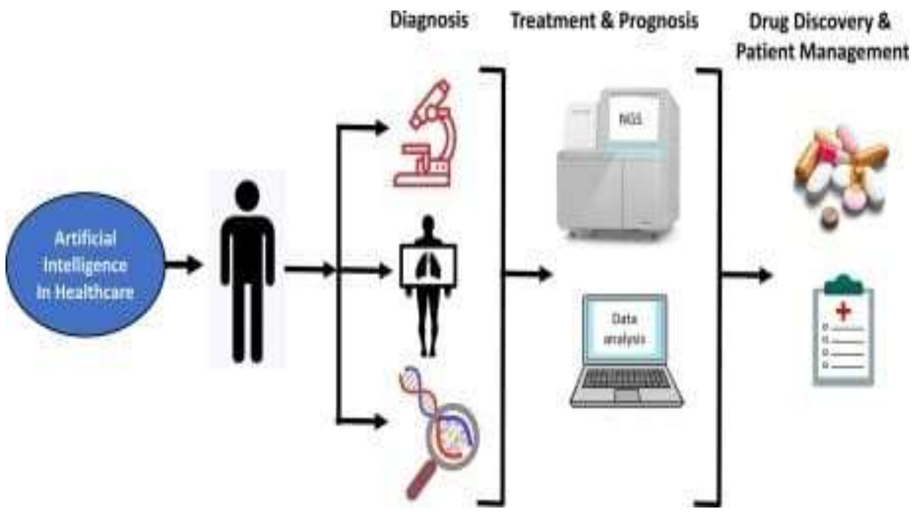
ABSTARCT

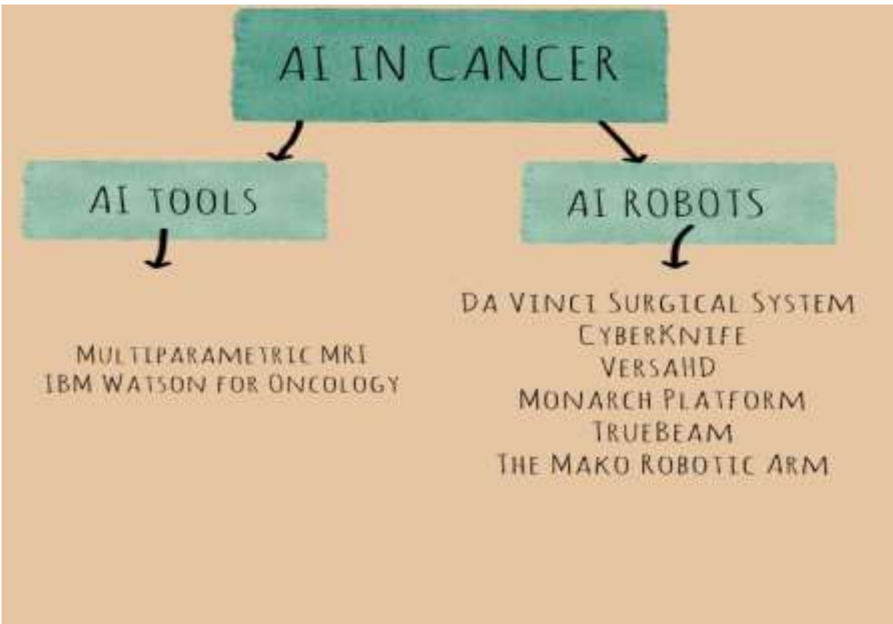
Cell that develop abnormally and have potential to develop spread other parts of body is known as cancer. Medical community first know about cancer in 1600s. Cancer is the most dangerous, spreadable and fatal to the patient's. So many treatments are available to treat the cancer sush as surgery, chemotherapy and radiation therapy. Nowadays the AI tools are used in cancer treatment. AI makes all treatments easy, effective and correct. Such AI tools are described below such as mpMRI, IBM Watson for Oncology, Da Vinci surgical system, CyberKnife, Versa HD, Monarch Platform, TrueBeam, The MAKO Robotic arm. This AI tools improve the surgical therapy and radiation therapy and chemotherapy more effective and convenient. Artificial Intelligence (AI) tools have increasingly been integrated into cancer diagnosis and treatment, enhancing precision, efficiency, and patient outcomes. Multiparametric MRI, powered by AI, improves tumor detection and characterization through advanced imaging analysis, offering more accurate insights into cancerous tissue. IBM Watson for Oncology supports oncologists by analyzing vast amounts of clinical data to suggest personalized treatment options based on evidence. The Da Vinci Surgical System utilizes robotic assistance, enhancing surgeons' precision during minimally invasive cancer surgeries. CyberKnife and VersaHD, AI-driven radiotherapy systems, deliver targeted radiation with high precision, minimizing damage to surrounding healthy tissues. The Monarch Platform aids in early lung cancer detection through AI-enhanced bronchoscopy. Lastly, TrueBeam is a versatile radiotherapy system that integrates AI to optimize radiation delivery, improving treatment accuracy for various cancer types. Together, these AI-powered tools revolutionize cancer care, making diagnosis and treatment more precise, personalized, and effective.

KEYWORDS: AI Tools, Cancer, mpMRI, IBM Watson for Oncology, Da Vinci surgical system, CyberKnife, VersaHD, Monarch Platform, TrueBeam, MAKO Robotic Arm.

INTRODUCTION

First of all, The ancient Greek term kapkivoc, which meaning crab and tumor, is where the word cancer originates. The medical community first learned about cancer in the 1600s, and it is thought to be caused by improperly developing cells with the capacity to invade or disseminate to different body regions. the understrained self proliferation that starts at one place in the body and spreads to other bodily locatins is known as cancer metastatis.[1] Numerous environmental causes, including chemicals, radiation, tobacco, and infectious organisms, can cause cancer. in addition to a few internal elements (random mutations, immunological conditions, harmones, and hereditary mutations).[2] Dr. Turkbey and associates, for instance, made use of established guidelines on the appearance of prostate cancer on MRI scans. "Artificial neural networks," which are used in deep learning technologies, are models of how brain cells receive, interpret, and respond to messages from other parts of the body.[3] The use of AI in oncology is helping the sector become more accurate, efficient, and personalized, which improves patient outcomes and increases effectiveness. Multiparametric MRI, IBM Watson for Oncology, Tempos, Viz AI, Zebra Medical Vision, Paige AI, and Kherion Medical Technology are a few names of AI tools used in cancer treatment. AI robots include the Da Vinci surgical system, the Cyberknife, VersaHD, Monarch platform, True beam, and Mak robotic arm aided surgery.most cancer patients have significance underlying diseases and tumor wounds that are incurable (diabetes, cvs disease, hypertension, etc.), which makes their post-operative quality of life inadequate. For the time being, the issue of how to select the optimal operation method needs to be resolved. As of right now, studies have shown that artificial intelligence (AI) can improves estimation of surgical risk, enabling optimal surgical technique selection.[4,5] For instance, IBM Watson for Oncology (WFO), a cognitive computing system, helps physicians rapidly find important information in patients' medical records, present pertinent evidence, and consider treatment alternatives by utilizing AI data analysis and image conversion capabilities.[5] The WFO therapy choice is therefore very congruent with the oncology committee's (MDT, or multidisciplinary team) recommendations. Additionally, the compressed data storage powered by AImethod (Compressed Data Storage method, or CDSS) might help doctors decide on the optimal surgical approach, particularly when the patient has lung cancer and straightforward therapy plan can be used to maximize outcome.[5,6]





Multiparametric MRI- the first magnetic resonance imaging (MRI) studies for prostate screening were carried out with a 0.35 T magnetized device at the start of the 1980s.[7,8] Improved magnet quality from 0.3T to 3T resulted in renewed clinical interest, while endorectal coil (ERC) technology and multiphasic sequencing provided additional incremental gains.[7,9] In a nutshell, multiparametric MRI (mpMRI) is the process of integrating T2-weighted (T2WI), diffusion weighted (DWI), dynamic contrast enhanced (DCEI), and, if needed, MR spectroscopy (MRSI) images in an effort to create the best possible three-dimensional (3D) prostate image. There is now no established standard combination, despite the fact that some centers have created their own MRI interpretation systems utilizing parts of these sections.[7,10]

Applications of mpMRI in the treatment of different cancers

1. The application of mpMRI in rectal cancer treatment: MRI is essential for rectal cancer staging both prior to and following treatment. When it comes to pretreatment staging, MRI has a greater accuracy rate than posttreatment evaluation. The inclusion of diffusion- and perfusion-weighted sequences to standard rectal MRI is known as multiparametric MRI of the rectum. Only a small number of publications—some of which are feasibility studies—have been published in the literature on this relatively new technique, which focuses on tumor biology. The use of diffusion-weighted imaging (DWI) depends on the randomly moving water molecules in tissues that are heated. When there is a change in the integrity of the cellular membrane and increased

cellularity, like when there is cancer tissue, DWI sequences clearly demonstrate the ensuing diffusion limitation in the tissue as hyperintensity. While not standard practice, the DWI technique has an incremental path in rectal cancer imaging primary and treatment response evaluation.[11]

2. mpMRI in prostate cancer diagnosis: Multiparametric MRI (mpMRI) of the prostate is a new and promising technique for the diagnosis of prostate cancer that may aid in lowering the number of unnecessary prostate cancer diagnoses.T1-weighted pictures, T2-weighted images, diffusion-weighted images (DWI), and dynamic contrast-enhanced imaging (DCEI) are the four sequences that should be included in mpMRI.[12] Some men can avoid an initial biopsy thanks to mpMRI, which also makes it easier to use MR-targeted prostate biopsies by allowing visualization of regions that are likely to have clinically relevant cancer before a biopsy is performed. This makes it possible to diagnose clinically unimportant diseases less frequently, detect and characterize higher-risk malignancies more accurately, and better choose patients for active surveillance. Furthermore, mpMRI can be utilized to plan treatment during surgery and focal therapy as well as to identify and monitor patients for active surveillance.[13]

Prostate MRI's workhorse is T2W1-T2-WI. The urethra, seminal vesicles, anterior fibromuscular stroma, ejaculatory ducts, central zone, peripheral zone from the transition zone, and seminal vesicles are all distinguished by the excellent spatial resolution it offers. On T2WI, the neurovascular bundles are also described. As a result of its increased water content, on T2W1, the periphery shows astrong signal intensity, and cancer in this region is shown as a reduced signal area.[14]

DWI

A functional imaging technique called diffusion-weighted MRI (DWI) quantifies the random Brownian motion of water molecules in tissue. is also the most helpful functional imaging sequence for transition zone tumor detection. DWI has been demonstrated in numerous studies to be the most successful mp-MRI sequence for identifying prostate cancer, thereby enhancing the diagnostic efficacy of mp-MRI.[14]

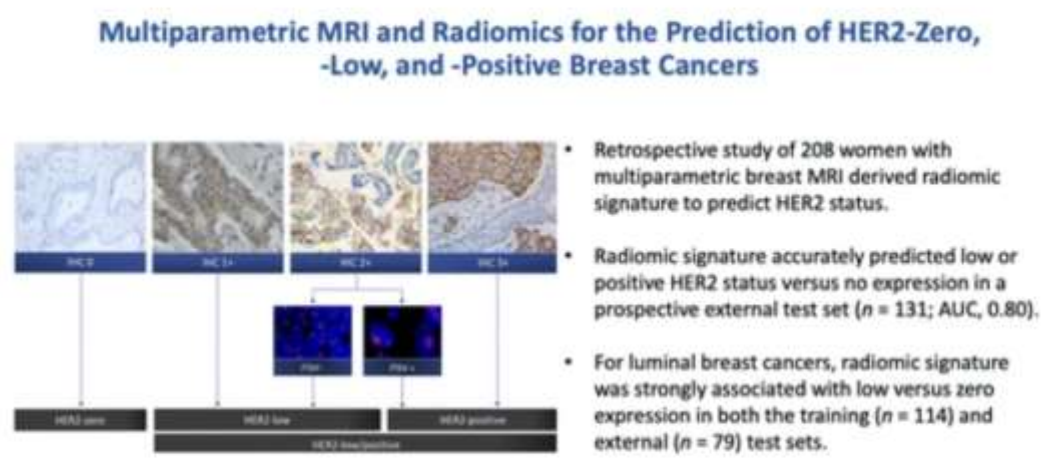
DCE

DCE MR imaging is a sophisticated prostate imaging technique that enables the determination of parameters that are intimately associated with angiogenesis and microvascular characteristics in tissues. Angiogenesis, or the blossoming of new blood vessels from existing blood vessels, and vasculogenesis, or the development of blood vessels from scratch, are caused by tumor hypoxia and the production of angiogenesis-inducing proteins, such as vascular endothelial growth factor. In general, tumor neovessels are more disordered, more diverse in size and branching pattern, and more permeable than normal vasculature.[15]

Breast cancer and multiparametric MRI

Multiparametric MRI is also utilized in breast imaging. According to a study we conducted, ½ of breast tumors have decreased levels of human epidermal growth factor receptor 2 expression, which makes them susceptible to novel antibody-drug conjugates.

Differential HER2 expressions of breast malignancies may be predicted using the MP MRI of breast radiomic sign and tumor descriptor, which could have therapeutic consequences.[16]



Multiparametric magnetic resonance imaging in bladder cancer

Differentiating between muscle-invasive and non-muscle-invasive bladder cancer is crucial for choosing the best course of action. A thorough assessment of multiparametric MRI (mp-MRI) is required, since it has shown a valuable technique for the T stages of bladder cancer. A crucial technique for bladder cancer T-staging is mMRI. For bladder cancer, we must understand the features of every mp-MRI sequence. Since VI-RADS scoring is a very useful tool, we suggested a diagnostic approach for patients with bladder cancer that used mp-

MRI and VI-RADS scoring prior to TUR-BT. Awaiting comparisons between mp-MRI scoring and TUR-BT staging utilizing the VI-RADS are multi-institutional studies.[17]

IBM Watson for Oncology

The debut of IBM Watson for Oncology, a service for cancer patients, was announced on July 29, 2016, by IBM and Manipal Hospitals, a renowned hospital chain in India. By providing information, this program assists physicians and patients in identifying personalized evidence based cancer treatment alternatives.[21]

China has started using IBM Watson for Oncology (WFO), which uses natural language processing to assess data in both structured and unstructured sources. In order to aid in treatment decision-making, it offers doctors evidence based treatment alternatives and places them into three categories. The purpose of this study was to determine if the treatment recommendations made by WFO and the actual clinical choices made by the doctors in our cancer center were consistent, reflecting the variations in cancer therapy between China andand the United States.[18] A clinical decision-support tool powered by artificial intelligence, Watson for Oncology (WFO) provides oncologists with evidence-based therapy recommendations.[19]

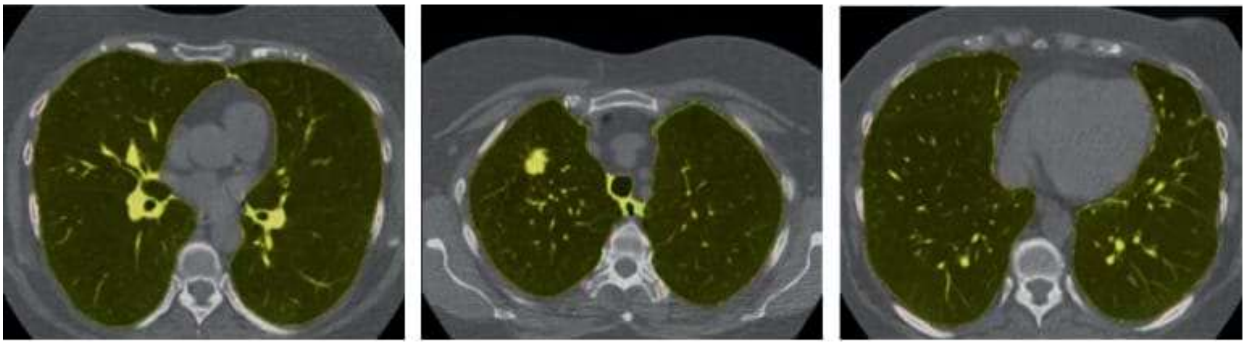
There are numerous studies that show agreement between WFO and real clinical practice in various cancers, such as gastric, colorectal, and breast cancer.[20]

Working: It recommended cancer treatments using artificial intelligence.

1. Watson was supplied a patient's medical record
2. Watson will be asked by the doctor. Watson will suggest a course of treatment a few seconds later.
3. Watson only suggests interventions from a predetermined selection. Nothing novel will accompany it.
4. It scans the list and removes treatments that are blatantly incorrect.
5. The treatment is then graded according to how appropriate it is. Rank assigns a score to each of them, but Watson is unable to explain why a certain treatment is given a particular score.
6. Watson divides the potential therapies into three groups: a) suggested treatment; b) treatment to be considered; and c) treatment that is not suggested.
7. Physicians view this ranking list in conjunction with published research and data supporting each treatment.

It can give medical professionals information to support their decisions.[22]

Da Vinci Surgical System: An endoscopic surgical instrument designed to support remote control procedures, the da Vinci surgical system was created in the United States by Intuitive Surgical Inc. The Da Vinci technology was initially applied to cardiothoracic surgeries in 1998.[23] In addition to being more safe and efficient, Da Vinci's robotic surgery technology cleans more lymph nodes while doing surgery. The fourth generation da vinci robot enables to the surgeon to view the trachea and dense blood arteries in the lungs. This allows the physician to identify diseased tissue more clearly and intuitively. Additionally, it has the ability to attenuate the faint tremor of the Simultaneously, it has the ability to eliminate the operator's hand's tiny tremor while operating. In addition, the Da Vinci robot does exceptionally well in lymph node dissection. The bedside manipulator operation system, the high-definition image display system, and the surgeon's operation control system make up the three primary components of Da Vinci's robotic surgery system.[24] In some situations, robotic surgery makes mediastinal tumor dissection safer, easier, and less invasive than open thoracotomy and traditional video-assisted thoracoscopic surgery.[25]

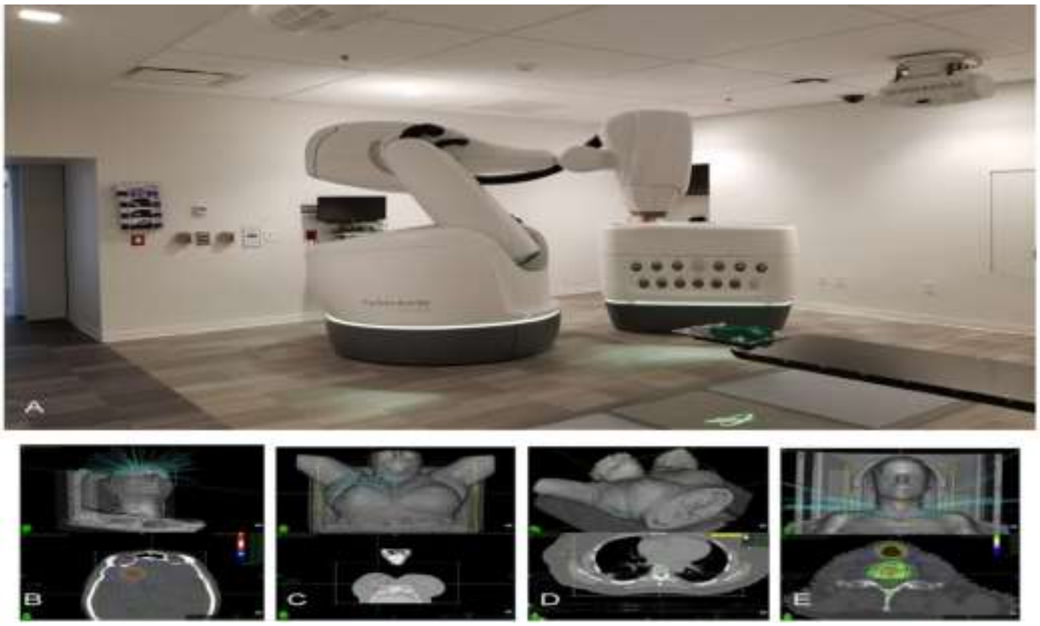


How the da Vinci system functions is:
* Mirroring hand gestures
The robot can spin and bend the instruments because the system translates the surgeon's hand movements at the console in real time.

* Offering a perspective in high resolution
The device offers a 3D high-definition picture of the operating area that is greatly magnified.

* Making tiny slashes
Through one or more small incisions, the technology enables surgeons to perform operations.

Cyberknife: The cyberknife is a radiotherapy tool that treats cancers with radiosurgery. Frameless radiation therapy is made possible by the CyberKnife© technology, which combines dynamic tracking with real-time visual guidance. In addition to its many uses, extended lifespan, and excellent local control, CyberKnife was also reasonably priced and produced less toxicity than previous radiation equipment.[26] Around the world, CyberKnife radiosurgery centers are being created; Stanford is home to the first one. The FDA just approved the use of the CyberKnife anywhere radiation therapy is indicated, all over the body. Dr. John Adler, the creator of the CyberKnife, is among the neurosurgeons at Stanford who are proficient in CyberKnife radiosurgery. Radiation therapy and focused irradiation are two applications for the image-guided stereotactical dose delivery device known as CyberKnife (SRT). The term "focal irradiation" describes the employment of numerous tiny beams to quickly and fractionally gives a little target area a highly targetd dosage. A digital x-ray imaging system and a 6-MV linac fixed to a robotic arm make up the system.[27]



VersaHd: It is utilized in cancer radiation therapy. The Versa HD precisely positions the patient for treatment using a robotic table that has six degrees of freedom. Elekta has introduced the Versa HD family of linear accelerators (Elekta Oncology Systems). It can produce electron beams, deflated photon beams, and filter-free (FFF) photon beams. For 6 MV FFF beams, the dose rates can reach up to 1400 MU/min, and for 10 MV FFF beams, up to 2400 MU/min. even though versa HD has been put into practice in numerous clinics worldwide, physicists are burdened with more work due to the lack of information regarding the acceptance and commissioning tests involved[28].• How it operates: The Versa HD creates a detailed image of the tumor and surrounding tissue using 2D, 3D, and 4D imaging. This enables medical professionals to modify the patient's position before to treatment by seeing how the tumor and organs move.

* Shape of beams
The radiation beam to the treatment area can be precisely shaped thanks to the Versa HD's Agility 160 leaf multi-leaf collimating technology.

* Delivery of treatment
Radiation therapies such as Image-Guided Radiotherapy (IGRT), Stereotactic Body Radiotherapy (SBRT), and Volumetric Modulated Arc Therapy (VMAT) can all be administered with the Versa HD.

* Positioning of the patient
The 6-degree of freedom (6DOF) couch on the Versa HD enables accurate patient adjustment and positioning during therapy.

* Modification of motion
The motion adjustment mechanism of the Versa HD helps to lessen side effects associated with therapy and Accelerate the healing process.

Monarch Platform: The Monarch Platform is a robotic bronchoscopy system that facilitates better access to small, difficult-to-reach lung nodules, aiding in the diagnosis of lung cancer by medical professionals.

Early diagnosis, lessening of the good and bad aspects, less adverse effects, and increased reach Vision and Control: In addition to supporting disease modeling and precision medicine, Monarch creates techniques and instruments that facilitate mechanistic investigation of the connections among using the tree of life to understand genetic constitution, physical composition enviornment.[29]

Truebeam: To cure cancer, TrueBeam is a radiation therapy device that combines motion control, imaging, and beam delivery. Patients can receive safe and successful therapy with truebeam radiosurgery. The Varian TruebeamTM real-time 2D motion management feature includes automatic beam hold, automated fiducial marker identification, and triggered imaging. This method offers a viable way to guarantee treatment precision when high dose per fraction stereotactic body radiation (SBRT) becomes more widely used.[30]

Mako Robotic Arm: Patients with orthopedic oncology may have joint replacement surgery using the Mako robotic arm, a surgical system. It can assist surgeons in carrying out less complicated, more precise, and predictable procedures. The state-of-the-art MAKO Robotic-Arm system uses three-dimensional planning and computed tomography (CT) scans to identify the optimal orientation and size of implants before bone excision. Adopted throughout the previous few decades, the MAKO Robotic-Arm System is currently used for total hip and complete knee arthroplasties. In some cases of orthopedic oncology, the MAKO Robotic-Arm System may present encouraging advantages over the conventional manual technique.[31]

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