How Does AI Support Tumor Board Decision Making?

Rasit Dinc

Rasit Dinc Digital Health & AI Research

Published: May 23, 2015 | AI in Oncology

DOI: 10.5281/zenodo.17999349

Abstract

Multidisciplinary tumor boards (MDTs) are the cornerstone of modern cancer care, bringing together a diverse team of specialists, including oncologists, surg...

How Does AI Support Tumor Board Decision Making?

Author: Rasit Dinc

Introduction

Multidisciplinary tumor boards (MDTs) are the cornerstone of modern cancer care, bringing together a diverse team of specialists, including oncologists, surgeons, radiologists, and pathologists, to collaboratively develop the most effective treatment plans for cancer patients. [1] By pooling their collective expertise, MDTs enhance diagnostic accuracy, improve adherence to clinical guidelines, and ultimately, personalize treatment strategies to improve patient outcomes. [2] However, the MDT process is not without its challenges. The coordination of busy specialists is a resource-intensive endeavor that can lead to treatment delays. [3] Furthermore, high case volumes can result in decision fatigue, while the inherent ambiguity in interpreting radiological and pathological data can introduce variability among experts. [4, 5] The rapid evolution of medical knowledge, with a constant stream of new biomarkers, clinical trial results, and therapeutic indications, further complicates the ability of clinicians to retrieve and synthesize the most up-to-date information in real-time. [6]

In recent years, artificial intelligence (AI) has emerged as a transformative technology with the potential to address many of these challenges. AI, encompassing a range of technologies from machine learning (ML) and natural language processing (NLP) to deep learning (DL) and large language models (LLMs), offers a suite of tools to augment and enhance the decision-making process within MDTs. [7] This article explores the evolving role of AI in supporting tumor board decisions, examining its benefits, limitations, and future prospects.

How AI is Revolutionizing Tumor Boards

AI is not a single entity but rather a collection of technologies, each with unique capabilities that can be applied to different aspects of the MDT workflow. These technologies are being leveraged to analyze vast and heterogeneous datasets, identify subtle patterns, extract salient information, and provide evidence-based recommendations that align with established clinical guidelines. [8]

Machine Learning (ML): *ML algorithms can be trained on large datasets of clinical and imaging data to automate tasks such as cancer staging and risk stratification. [9] These models can identify complex patterns that may not be readily apparent to the human eye, leading to more accurate and consistent assessments.* **Natural Language Processing (NLP):** NLP enables computers to understand and process human language, a capability that is particularly valuable in the context of MDTs. NLP can be used to extract critical information from unstructured clinical notes, pathology reports, and radiology reports, and synthesize this information into concise and structured summaries. [10] ***Deep Learning (DL):*** *DL, a subfield of ML, has shown remarkable success in image-based tasks. In oncology, DL models are being used to analyze medical images, such as CT scans and MRIs, to detect and characterize tumors with a high degree of accuracy. [11]* **Large Language Models (LLMs):** LLMs, such as ChatGPT, are a recent advancement in AI that have demonstrated impressive capabilities in generating human-like text. In the context of MDTs, LLMs can be used to generate transparent, evidence-linked treatment recommendations and even patient-facing documents. [12]

Benefits of AI in Tumor Boards

The integration of AI into the MDT workflow offers a multitude of benefits, all of which contribute to the overarching goal of improving patient care.

Improved Efficiency: *AI can automate many of the time-consuming tasks associated with preparing for an MDT meeting, such as data extraction and summarization. This frees up clinicians to focus on the more complex aspects of decision-making.* **Enhanced Consistency:** By standardizing the input data and providing evidence-based recommendations, AI can help to reduce inter-observer variability and ensure that all patients receive care that is consistent with the latest clinical guidelines. [13] ***Personalized Care:*** *AI has the potential to usher in a new era of personalized medicine. By analyzing a patient's unique genomic and clinical data, AI models can help to identify the most effective treatment options for that individual.* **Augmented Decision-Making:** It is crucial to emphasize that AI is not intended to replace human clinicians but rather to augment their decision-making capabilities. AI can serve as a powerful "second opinion," providing clinicians with additional insights and perspectives to consider.

The Limitations and Challenges of AI

Despite its immense potential, the use of AI in tumor boards is still in its early stages, and there are several limitations and challenges that need to be addressed.

Data Bias and Generalizability: *AI models are only as good as the data they are trained on. If the training data is not representative of the broader patient population, the model may not perform well on underrepresented subgroups. [13]* **Lack of Prospective Validation:** Much of the research on AI in oncology has been retrospective in nature. There is a need for more prospective, real-world studies to validate the performance of these models in a clinical setting. [13] ***Privacy and Governance:*** *The use of patient data to train AI models raises important privacy and governance concerns. Robust safeguards must be in place to protect patient confidentiality.* **The "Black Box" Problem:** The decision-making processes of some AI models, particularly deep learning models, can be opaque, making it difficult to understand how they arrived at a particular recommendation. This lack of transparency can be a barrier to trust and adoption.

A recent study comparing the performance of ChatGPT-4o with an in-house tumor board for complex cancer cases found that while there was high inter-rater reliability, the concordance between the AI and the tumor board was low. [14] The study concluded that "AI, in its current form, is not yet capable of functioning as a standalone decision-maker in the management of challenging oncology cases. Clinical experience and expert judgment remain the most critical factors in guiding patient care." [14]

The Future of AI in Oncology

The future of AI in oncology is bright, but it is a future that will be built on a foundation of rigorous research, validation, and collaboration. As AI models become more sophisticated and the challenges of data bias and transparency are addressed, we can expect to see AI play an increasingly integral role in the MDT process. The ultimate goal is to create a synergistic partnership between human and artificial intelligence, where the strengths of each are leveraged to provide the best possible care for every cancer patient.

Conclusion

Artificial intelligence is poised to revolutionize the field of oncology, and its impact on multidisciplinary tumor boards is already being felt. From automating routine tasks to providing evidence-based treatment recommendations, AI has the potential to enhance the efficiency, consistency, and personalization of cancer care. However, it is essential to recognize that AI is a tool to augment, not replace, the expertise of human clinicians. As we move forward, a thoughtful and evidence-based approach to the integration of AI into the MDT workflow will be critical to realizing its full potential and ensuring that it is used in a way that is safe, effective, and equitable for all patients.