EFFECTIVENESS, SAFETY AND THE DEVELOPING USE OF AI AND DEEP LEARNING IN PATIENT STRATIFICATION AND ADVERSE EVENT PREDICTION FOR CHECKPOINT INHIBITORS IN CANCER IMMUNOTHERAPY

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ABSTRACT

Checkpoint inhibitors have revolutionized cancer immunotherapy by reactivating immunity to attack the tumor cells and providing long-term clinical responses in a number of malignant conditions like melanoma, non-small cell lung cancer, or renal cell carcinoma. These being said, clinical outcomes differ much across patients, and irAEs continue to threaten their lives, often causing problems in many organ systems. AI and DL have brought about a thrilling revolution into the field for better patient stratification, early irAE prediction, and all-round superior therapeutic decision-making. It describes the mechanisms of action of checkpoint inhibitors and assesses their efficacy and safety profile and places a view on how AI-assisted tools are assisting the field of patient-tailored management. By harnessing data sets from sources including genomics, imaging, and clinical records, AI models translate data into actionable insights for therapy outcome and adverse event risk prediction. The marriage of immunotherapy and computational intelligence may someday literally be employed to right this way toward safer, more efficient, and patient-tailored cancer treatment options.

Keywords: *Immune Checkpoint Inhibitors (ICIs), Cancer Immunotherapy, Artificial Intelligence (AI), Deep Learning, Immune-Related Adverse Events (irAEs)*

1. INTRODUCTION

In recent years, immunotherapy has truly metamorphosed the field of oncology for the benefit of those few patients afflicted with advanced and treatment-resistant cancers. ICIs sit at the zenith of this revolution as they target regulatory molecules such as CTLA-4, PD-1, and its ligand PD-L1. Having freed the immune system from its brakes, ICIs empowered cytotoxic T cells to induce a more effective assault on tumor cells thereby bringing about significant clinical benefits in recognized malignancies such as melanoma, non-small cell lung cancer, and renal cell carcinoma [1]. Immune system complexities and tumor heterogeneity come in-between the massive challenges. To circumvent these problems, artificial intelligence and deep learning have gained interest due to their ability to tackle medical data integration and thus improve patient stratification, irAE predictions, and treatment selection for individual patients [2–4].