INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Article

Comparative Evaluation of New-Generation Anticancer Drugs for Improved Patient Outcomes

Dr. Vinuth Chikkamath, J. S. Venkatesh, Dona Sajan*, Feba. G. Jose, Ferina U., Nashreennisa Begum

SCS College of Pharmacy, Harapanahalli.

ARTICLE INFO

Published: 12 Dec 2025

Keywords:
Targeted therapy, immunotherapy, monoclonal antibodies, ADCs, progression-free survival, precision oncology

DOI:
10.5281/zenodo.17906865

ABSTRACT

Cancer remains one of the leading causes of global mortality and morbidity, and traditional chemotherapy—although effective in tumor shrinkage—has significant limitations due to nonspecific cytotoxicity, drug resistance and severe toxicity profiles. Recent scientific advances in molecular oncology and immunotherapy have facilitated the development of new-generation anticancer drugs, including targeted therapy, immunotherapy, monoclonal antibodies, antibody–drug conjugates (ADCs), PARP inhibitors, CAR-T cell therapy and next-generation hormonal agents. These therapies enable precision treatment by selectively targeting malignant cells, improving survival outcomes, reducing systemic toxicity and enhancing quality of life. Comparative evaluation demonstrates that new-generation anticancer drugs provide improved progression-free survival and response rates across major cancers such as breast cancer, lung cancer, leukemia, lymphoma, and melanoma. However, challenges including adverse immune-mediated reactions, high cost, limited accessibility and development of resistance still remain. This journal review discusses mechanisms, clinical efficacy, toxicity comparison, limitations, and future perspectives in the transition from conventional to novel anticancer drug therapy to improve patient outcomes.

INTRODUCTION

Cancer is a complex, heterogeneous, and life-threatening disease characterized by uncontrolled cell proliferation and metastatic potential. Globally, cancer constitutes one of the most formidable public health challenges, contributing to millions of deaths every year and exerting significant financial and social burdens. The rising incidence is associated with several factors—including increased life expectancy, genetic predisposition, lifestyle modifications, environmental pollution, occupational exposure to carcinogens, physical inactivity, obesity, tobacco

***Corresponding Author:** Dona Sajan
Address: *SCS College of Pharmacy, Harapanahalli.*
Email ✉: donaannasajan2001@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

and alcohol consumption. The rapid global increase in cancer cases demands more effective therapeutic strategies that not only improve survival but also optimize patient quality of life.

For decades, conventional chemotherapy and radiotherapy remained the mainstay of cancer treatment. These therapies operate by indiscriminately destroying rapidly dividing cells, affecting both cancerous and healthy tissues. This lack of selectivity frequently results in severe toxicities, such as anemia, neutropenia, nausea, neurotoxicity, alopecia, mucositis, and immunosuppression. Moreover, tumor cells often develop drug resistance through genetic mutations and adaptive metabolic mechanisms, which reduce long-term treatment success and lead to relapse or metastatic progression. Although conventional therapies remain essential in curative and adjuvant settings, their limitations highlight the need for more advanced therapeutic modalities.

Advancements in genomics, proteomics, immunology, and tumor microenvironment research have revolutionized cancer treatment through **precision medicine**, where therapeutic decisions are guided by individual molecular signatures. This led to the emergence of **new-generation anticancer drugs** such as tyrosine kinase inhibitors (TKIs), immune checkpoint inhibitors (ICIs), monoclonal antibodies (mAbs), antibody–drug conjugates (ADCs), PARP inhibitors, CAR-T cell therapy, and next-generation hormonal modulators. These modern therapies offer enhanced tumor specificity, reduced toxicity, improved survival outcomes, and better tolerability compared to conventional chemotherapeutic agents.

The clinical impact of these new-generation therapies is evident across several cancer types. For example, immune checkpoint inhibitors such as pembrolizumab and nivolumab have transformed metastatic melanoma outcomes; targeted therapies such as imatinib have revolutionized chronic myeloid leukemia management, increasing long-term survival dramatically; HER2-targeted agents like trastuzumab and trastuzumab-deruxtecan significantly improved survival in HER2-positive breast cancer. However, despite their benefits, new-generation drugs face challenges such as high cost, immune-related adverse events, limited biomarker identification, complex administration protocols, and resistance mechanisms.

Therefore, a comparative evaluation of these modern anticancer drugs with conventional treatments is essential to understand their advantages, challenges, and future opportunities for improving patient prognosis and quality of life.

DISCUSSION

Classification of New-Generation Anticancer Drugs

Category	Examples	Mechanism	Key Benefits
Targeted therapy (TKIs)	Imatinib, Osimertinib, Erlotinib	Inhibit specific molecular pathways such as EGFR, ALK	High specificity, minimal toxicity
Immunotherapy (ICIs)	Pembrolizumab, Nivolumab	Block PD-1, PD-L1, CTLA-4 immune evasion pathways	Durable immune response
Monoclonal antibodies	Rituximab, Trastuzumab	Target specific tumor antigens	Reduced systemic toxicity
Antibody-drug conjugates	T-DM1, Enhertu	Targeted cytotoxic delivery	Effective in resistant tumors

PARP inhibitors	Olaparib, Niraparib	Synthetic lethality for BRCA-mutated cancers	Personalized therapy
CAR-T cell therapy	Tisagenlecleucel	Genetically engineered T-cell targeting	High remission in leukemias

Comparative Efficacy with Traditional Chemotherapy

Parameter	Conventional Chemotherapy	New-Generation Drugs
Selectivity	Nonspecific	Targeted to tumor pathways
Toxicity	High systemic toxicity	Lower toxicity, more tolerable
Survival improvement	Moderately effective	Long-term remission possible
Resistance	Common	Reduced, mutation-specific
Quality of life	Poor	Significantly improved
Immune response	Suppressed	Activated and enhanced

Clinical Outcome Improvements

- ✓ Pembrolizumab improves melanoma survival up to 5× compared to dacarbazine.
- ✓ Imatinib increased 10-year survival in CML from <30% to >80%.
- ✓ HER2-targeted therapy decreased breast cancer recurrence significantly.
- ✓ CAR-T therapy offers remission in 60–90% of relapsed leukemia patients.

Limitations and Challenges

- ✓ Immune toxicities (colitis, pneumonitis, myocarditis).
- ✓ Development of resistance (e.g., EGFR T790M mutation).
- ✓ Very high cost restricting accessibility in low-income settings.
- ✓ Lack of validated biomarkers for predicting responders.

CONCLUSION

New-generation anticancer drugs represent a major advancement in cancer management offering improved precision, reduced toxicity, enhanced survival, and better quality of life compared to traditional chemotherapy. Their clinical benefits have transformed treatment outcomes for several malignancies. However, challenges related to cost, adverse events, and resistance emphasize the need for continued research, combination strategies, biomarker-based selection, and improved accessibility. Future oncology will increasingly rely on personalized medicine and integrated therapeutic models for optimal patient outcomes.

REFERENCES

1. Siegel RL, Giaquinto AN, Jemal A. Cancer statistics, 2024. CA Cancer J Clin. 2024 Jan-Feb;74(1):12-49
2. Patel SP, Othus M, Chen Y, et al. Neoadjuvant–Adjuvant or Adjuvant-Only Pembrolizumab in Advanced Melanoma. N Engl J Med. 2023;388(9):813-823..

3. Slamon D, Eiermann W, Robert N et al. Breast Cancer International Research Group. Adjuvant trastuzumab in HER2-positive breast cancer. N Engl J Med. 2011 Oct 6; 365 (14): 1273-83
4. Lee CS, Milone M, Seetharamu N. Osimertinib in EGFR-Mutated Lung Cancer: A Review of the Existing and Emerging Clinical Data. Onco Targets Ther. 2021 Aug 26; 14: 4579-4597.
5. Testa U, Sica S, Pelosi E, Castelli G, Leone G. CAR-T Cell Therapy in B-Cell Acute Lymphoblastic Leukaemia. Mediterr J Hematol Infect Dis. 2024 Jan 1; 16(1) : e2024010
6. Riccardi F, Dal Bo M, Macor P, Toffoli G. A comprehensive overview on antibody-drug conjugates: from the conceptualization to cancer therapy. Front Pharmacol. 2023 Sep 18; 14: 1274088.
7. Qin Z, Zheng M. Advances in targeted therapy and immunotherapy for melanoma (Review). Exp Ther Med. 2023 Jul 13; 26(3): 416
8. Lahiri, A., Maji, A., Potdar, P.D. et al. Lung cancer immunotherapy: progress, pitfalls, and promises. Mol Cancer 22, 40 (2023).
9. Zamani MR, Šácha P. Immune checkpoint inhibitors in cancer therapy: what lies beyond monoclonal antibodies: Med Oncol. 2025 Jun 19; 42(7): 273
10. David J. Duffy, Problems, challenges and promises: perspectives on precision medicine, Briefings in Bioinformatics, Volume 17, Issue 3, May 2016, 494–504.

HOW TO CITE: Dr. Vinuth Chikkamath, J. S. Venkatesh, Dona Sajan*, Feba. G. Jose, Ferina U., Nashreennisa Begum, Comparative Evaluation of New-Generation Anticancer Drugs for Improved Patient Outcomes, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 12, 1988-1991 https://doi.org/10.5281/zenodo.17906865