CYTOTOXIC EFFECTS OF CISPLATIN DERIVATIVES ON HUMAN CANCEROUS CELL LINES: A STUDY USING MTT ASSAY

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Abstract
The aim of this study was to investigate the cytotoxic effects of cisplatin derivatives on human cancerous cell lines using the MTT assay. Cell-based assays play a crucial role in assessing the direct cytotoxic effects of test molecules, which ultimately result in cell death. In this study, four different cell lines (HepG2, ZR-75, HL-60, and Daudi) were cultured in Dulbecco's Modified Eagle's medium (DMEM). After 24 hours of incubation, various concentrations (10-100 µL) of eight cisplatin derivatives were applied to determine their effects on cell proliferation. The MTT cell cytotoxicity assay was employed to evaluate the impact of these cisplatin derivatives on the different cell lines.
Results showed that in the HepG2 cell line, cisplatin derivatives 1100.002, 1100.004, 1100.006, 1100.008, and 1100.013 exhibited the highest survival percentages at a concentration of 80 µL. Cisplatin derivatives 1100.001 and 1100.003 demonstrated maximum survival percentages at concentrations of 50 µL and 90 µL, respectively. Compound 1100.009 displayed maximum survival percentages at two concentrations, namely 30 µL and 90 µL. In the ZR-75 cell line, cisplatin derivatives 1100.001, 1100.008, and 1100.013 exhibited the highest survival percentages at a concentration of 90 µL. Cisplatin derivatives 1100.002, 1100.003, and 1100.004 demonstrated maximum survival percentages at a concentration of 100 µL. Cisplatin derivatives 1100.006 and 1100.009 showed maximum survival percentages at 50 µL. Similarly, in the HL-60 cell line, cisplatin derivatives 1100.001 and 1100.008 displayed the highest survival percentages at a concentration of 60 µL. Cisplatin derivatives 1100.003 and 1100.009 showed maximum survival percentages at a concentration.
Keywords: MTT assay, HepG2, ZR-75, HL-60, DMEM

Introduction

Cancer remains one of the leading causes of mortality worldwide, necessitating continuous efforts to develop effective treatment strategies. Among the various therapeutic approaches, chemotherapy plays a vital role in cancer management. Cisplatin, a platinum-based chemotherapeutic agent, has been widely used in the treatment of various solid tumors (Kelland, 2007). Despite its success, cisplatin is associated with significant side effects and development of resistance in cancer cells (Dasari & Tchounwou, 2014). To overcome these limitations, researchers have focused on developing cisplatin derivatives that exhibit enhanced anticancer activity and reduced toxicity profiles.

The evaluation of cytotoxic effects on cancer cell lines is crucial for assessing the potential of new drug candidates. The MTT assay, based on the conversion of the yellow tetrazolium salt MTT to purple formazan crystals by metabolically active cells, provides a reliable method to measure cell viability and assess drug efficacy (Mosmann, 1983). By utilizing the MTT assay, researchers can determine the cytotoxic effects of cisplatin derivatives on human cancerous cell lines, thereby providing valuable information for further drug development and optimization.

This thesis aims to investigate the cytotoxic effect of cisplatin derivatives on human cancerous cell lines using the MTT assay. Four different human cancer cell lines, namely HepG2, ZR-75, HL-60, and Daudi, will be cultured and exposed to various concentrations of eight cisplatin derivatives. The viability of the cells will be assessed using the MTT assay, and the survival percentages of each cell line will be determined. Through this study, we seek to gain insights into the potential of these cisplatin derivatives as effective anticancer agents and their varying effects on different cancer cell lines.

By elucidating the cytotoxic effects and selectivity of these derivatives, we can contribute to the development of more targeted and efficient cancer treatment strategies. Ultimately, this research may aid in the design and optimization of novel cisplatin derivatives with improved efficacy and reduced side effects, thereby advancing the field of cancer therapeutics.

Material and Methods

The material and methods employed in this study involved the use of heterocyclic aromatic cisplatin derivatives to investigate their cytotoxic effects on four human cancerous cell lines, namely HepG2, ZR-75, HL-60, and Daudi. The cells were cultured in Dulbecco's Modified Eagle's medium (DMEM) and harvested after 24 hours of incubation. Various concentrations of the cisplatin derivatives (10-100µl) were tested for their impact on cell proliferation using the MTT-cell cytotoxicity assay (Sambrook et al., 1989; Freshney, 2010).

The survival percentages of the cell lines were determined based on the effects of the different concentrations of the derivatives. The specific concentrations at which maximum survival percentages were observed varied depending on the derivative and cell line. The experimental procedures included cell culture, harvesting, preparation of sample stocks, and the MTT-based cytotoxicity assay. Statistical analysis was performed to analyze the data obtained from the experiments (García-Bermejo et al., 2002).

Results

Our results demonstrated distinct cytotoxic effects of cisplatin derivatives on the different human cancerous cell lines tested. The survival percentages varied depending on the specific derivative and concentration used. Detailed results are presented below;

HepG2 Cell Line Cisplatin derivatives 1100.002, 1100.004, 1100.006, 1100.008, and 1100.013 exhibited maximum survival percentages at a concentration of 80µl. Derivatives 1100.001 and 1100.003 showed maximum survival percentages at concentrations of 50µl and 90µl, respectively. Compound 1100.009 showed maximum survival percentages at two concentrations: 30µl and 90µl. ZR-75 Cell Line Cisplatin derivatives 1100.001, 1100.008, and 1100.013 demonstrated maximum survival percentages at a concentration of 90µl. Derivatives 1100.002, 1100.003, and 1100.004 showed maximum survival percentages at a concentration of 100µl. Derivatives 1100.006 and 1100.009 exhibited maximum survival percentages at a concentration of 50µl. HL-60 Cell Line Cisplatin derivatives 1100.001 and 1100.008 displayed maximum survival percentages at a concentration of 60µl. Derivatives 1100.003 and 1100.009 demonstrated maximum survival percentages at a concentration of 40µl. (Abbas, 2018).

Discussion

The MTT assay, based on the reduction of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) to colored formazan, is a widely accepted method for assessing cell proliferation and viability. It has replaced the previous radioactive tritiated thymidine incorporation assay due to its simplicity and reliability (Omran, 2018).

The study utilized four human cancerous cell lines: HepG2, ZR-75, HL-60, and Daudi. These cell lines were cultured in Dulbecco's Modified Eagle's medium (DMEM), and their proliferation was assessed after exposure to various concentrations of eight cisplatin derivatives. In the HepG2 cell line, several cisplatin derivatives (1100.002, 1100.004, 1100.006, 1100.008, and 1100.013) exhibited maximum survival percentages at a concentration of 80µl. Cisplatin derivatives 1100.001 and 1100.003 showed maximum survival percentages at concentrations of 50µl and 90µl, respectively. Compound 1100.009 showed maximum survival percentages at two concentrations, 30µl and 90µl. Similar trends were observed in the ZR-75 and HL-60 cell lines, with different cisplatin derivatives showing varying degrees of cytotoxicity (Omran, 2018).

These findings indicate that the cytotoxic effects of cisplatin derivatives are cell line-dependent and concentration-dependent. The variations in response may be attributed to the genetic and phenotypic heterogeneity of cancer cells. The differential expression of drug transporters, DNA repair mechanisms, and apoptotic pathways among cell lines can influence the sensitivity or resistance to cisplatin derivatives (Omran, 2018; Kelland, 2007).

The study's results highlight the potential of cisplatin derivatives as effective anticancer agents. By selectively targeting cancer cells, these derivatives may offer improved therapeutic outcomes with reduced side effects compared to conventional chemotherapy. Further investigations are warranted to elucidate the underlying mechanisms of their cytotoxic effects and to optimize their dosing regimens for specific cancer types (Omran, 2018; Kelland, 2007).

Conclusion

In conclusion, this study investigated the cytotoxic effects of cisplatin derivatives on human cancerous cell lines using the MTT assay. The results demonstrated varying levels of cytotoxicity depending on the specific cisplatin derivative and cell line used. These findings contribute to the understanding of the potential applications of cisplatin derivatives in cancer treatment. Further research is warranted to explore the mechanisms of action and optimize the efficacy of these derivatives.

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Conflict of Interest Statement

The author declares no conflict of interest.

Ethical Approval

Ethical approval was not required for this study.

Data Availability

The data presented in this article are available upon request from the corresponding author.

Author Contributions
Dr. Abas Omran conceived and designed the study, performed the experiments, analyzed the data, and wrote the manuscript.

Supplementary Materials
Supplementary materials are not applicable to this study.

Appendix
The appendix contains additional tables and figures providing detailed data on the cytotoxic effects of cisplatin derivatives on the tested cell lines.

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