FAKULTAS KEDOKTERAN
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" JAKARTA

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PRISILIA QURRATU AINI, No. NIM 2210211039

EFEKTIVITAS SEL T SITOTOKSIK DALAM INDUKSI KEMATIAN GALUR SEL KANKER PAYUDARA MCF-7 SECARA *IN VITRO*

RINCIAN HALAMAN (xv + 84 halaman, 23 tabel, 9 gambar, 3 bagan)

ABSTRAK

Tujuan: Kanker payudara merupakan keganasan dengan insidensi tertinggi pada wanita di Indonesia (66.271 kasus/tahun) dengan 70,9% terdiagnosis stadium lanjut. Keterbatasan terapi konvensional mendorong eksplorasi imunoterapi berbasis sel T sitotoksik. Penelitian ini bertujuan mengevaluasi efektivitas sel T sitotoksik endogen dari pasien kanker payudara dalam menginduksi kematian galur sel MCF-7 secara *in vitro.*
Metode: Penelitian *analitik eksperimental in vitro*. Sel T sitotoksik diisolasi dari PBMC pasien kanker payudara, diaktivasi dengan anti-CD3, dan diko-kultur dengan MCF-7 selama 72 jam pada rasio *Efektor:Target* 10:1, 20:1, dan 50:1. Evaluasi menggunakan *mikroskop inverted* (morfologi), flowsitometri *Annexin V-PI* (viabilitas/apoptosis), dan qRT-PCR (ekspresi BCL-2 dan p53). Analisis statistik menggunakan *ANOVA* dan *uji Tukey* (α=0,05).
Hasil: Karakterisasi sel T menunjukkan peningkatan CD3+/CD8+ dari 5,26% menjadi >94% dan NKG2D+ >98%. Pada rasio 10:1 dan 20:1, *viabilitas*menurun minimal (86-87%) dengan dominasi apoptosis (rasio apoptosis*:nekrosis* 2,5:1). Pada rasio 50:1, *viabilitas*menurun drastis (38,24%) namun didominasi *nekrosis* (50%). Ekspresi BCL-2 menurun signifikan pada semua perlakuan ($p<0,0001$): 56% (10:1), 51% (20:1), 20% (50:1). Ekspresi p53 mengalami *downregulasi masif* 96-99% pada semua rasio ($p<0,0001$), mengindikasikan mekanisme sitotoksik p53-independent.
Kesimpulan: Sel T sitotoksik endogen efektif menginduksi kematian sel MCF-7. Rasio 10:1 dan 20:1 menghasilkan apoptosi*s* terprogram dengan sitotoksisitas terbatas, sedangkan rasio 50:1 menghasilkan *killing* tinggi namun didominasi *nekrosis non-spesifik*. Eksplorasi rasio intermediate (30:1-40:1) direkomendasikan untuk optimasi.

Daftar Pustaka : 56 (2015 – 2025)
Kata Kunci : sel T sitotoksik, MCF-7, kanker payudara, apoptosis, imunoterapi, *in vitro*

FACULTY OF MEDICINE
UNIVERSITY PEMBANGUNAN NASIONAL "VETERAN" JAKARTA

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PRISILIA QURRATU AINI, No. NIM 2210211039

THE EFFECTIVENESS OF CYTOTOXIC T CELLS IN INDUCING CELL DEATH OF MCF-7 BREAST CANCER CELL LINE IN VITRO

PAGE DETAIL (xv + 84 pages, 23 tables, 9 figures, 3 charts)

ABSTRACT

Objective: *Breast cancer remains the most prevalent malignancy among women in Indonesia, with 66,271 new cases annually and 70.9% diagnosed at advanced stages. The limitations of conventional therapies have driven the exploration of T cell-based immunotherapy as a promising alternative modality. This study aimed to evaluate the effectiveness of endogen ous cytotoxic T cells from breast cancer patients in inducing MCF-7 cell line death in vitro without genetic or pharmacological modification.*
Methods: *This quantitative analytical experimental study was conducted in vitro. Cytotoxic T cells were isolated from breast cancer patient PBMCs, activated with anti-CD3, and ko-kultur d with MCF-7 cells for 72 hours at Effector:Target ratios of 10:1, 20:1, and 50:1. Evaluation was performed using inverted microscopy (morphology), Annexin V-PI flow cytometry (viability/apoptosis), and qRT-PCR (BCL-2 and p53 expression). Statistical analysis employed ANOVA and Tukey's test (α=0.05).*
Results: *T cell characterization showed CD3+/CD8+ population increase from 5.26% to >94% and NKG2D+ >98% post-activation. At 10:1 and 20:1 ratios, viability decreased minimally (86-87%) with apoptosis dominance (apoptosis:necrosis ratio 2.5:1). At 50:1 ratio, viability decreased dramatically (38.24%) but was dominated by necrosis (50%). BCL-2 expression decreased significantly across all treatments ($p<0.0001$): 56% (10:1), 51% (20:1), 20% (50:1). p53 expression showed massive downregulation of 96-99% across all ratios ($p<0.0001$), indicating a p53-independent cytotoxic mechanism.*
Conclusion: *Endogen ous cytotoxic T cells effectively induced MCF-7 cell death. Ratios of 10:1 and 20:1 produced programmed apoptosis with limited cytotoxicity, while 50:1 ratio achieved high killing efficacy but was dominated by non-specific necrosis. Exploration of intermediate ratios (30:1-40:1) is recommended for optimization.*

References *: 56 (2015 – 2025)*
Keywords *: cytotoxic T cells, MCF-7, breast cancer, apoptosis, immunotherapy, in vitro*