

**Efek Paparan Medan Listrik Statis Frekuensi 150 kHz terhadap Sel Positif ErbB2 dan Infiltrasi Makrofag CD68 pada Jaringan Tumor Payudara Tikus (*Rattus norvegicus* Berkenhout, 1769)**

**ABSTRAK**

Salah satu kelemahan dari metode yang umum untuk terapi kanker payudara yakni menimbulkan efek samping. Untuk mengatasi efek samping yang muncul, maka dikembangkan metode alternatif yakni terapi medan listrik. Medan listrik statis dengan frekuensi menengah mampu menghambat proliferasi sel kanker. Kanker payudara yang mengekspresikan protein ErbB2 atau HER2 mengindikasikan keadaan yang agresif dan invasif. Di sisi lain, sel kanker dapat memicu sel imun bawaan yakni makrofag yang dapat bersifat antiinflamasi dan proinflamasi. Penelitian ini bertujuan untuk mempelajari efek medan listrik statis frekuensi 150 kHz dengan intensitas 18 Vpp terhadap perkembangan sel kanker dengan biomarker ErbB2 dan infiltrasi makrofag CD68 pada jaringan kanker. Hewan model yang digunakan adalah tikus yang diinduksi dengan *7,12-dimethylbenz[ $\alpha$ ]anthracene* (DMBA). penelitian ini menggunakan 4 perlakuan yaitu kelompok non-induksi non-terapi (NINT), non induksi- terapi (NIT), induksi-non terapi (INT) dan Induksi-terapi (IT) menggunakan alat ECCT (*Electro- Capacitive Cancer Therapy*), dengan ulangan masing-masing 6 ekor. Perlakuan kelompok induksi dilakukan setelah muncul nodul tumor dengan diameter 1 cm. Hasil yang diamati adalah pertumbuhan sel tumor yang bersifat karsinoma atau kanker, tipe sel kanker yang positif ErbB2, dan infiltrasi makrofag CD68 beserta karakteristiknya dengan pewarna Hematoksin-Eosin dan Immunohistokimia Hasil pengamatan pola pertumbuhan jaringan tumor menunjukkan pertumbuhan adenokarsinoma dengan pola yang beragam pada tikus yang diinduksi DMBA. Pola yang muncul pada kelompok INT menunjukkan kanker yang lebih invasif dibandingkan pada kelompok IT. Pengamatan terhadap sel positif ErbB2 pada kelompok INT secara signifikan lebih banyak jumlahnya 25,55% dibandingkan dengan kelompok IT 19,43%. Pengamatan terhadap infiltrasi makrofag CD68 menunjukkan kelompok IT signifikan lebih banyak dengan rerata jumlah makrofag 10,5 sel dibandingkan kelompok INT 5,6 sel. Hasil penelitian ini menunjukkan bahwa paparan medan listrik statis frekuensi 150 kHz mampu menurunkan jumlah sel yang mengekspresi protein ErbB2 dan meningkatkan infiltrasi makrofag pada jaringan kanker payudara tikus.

**Kata kunci :** ErbB2, kanker payudara tikus, medan listrik, makrofag

***Effects of Field Exposure of The Static Electricity Frequency 150 Khz on the Erbb2 Positive Cells and Infiltration of CD68 Macrophages in Rat Breast Cancer Tissue (*Rattus norvegicus* Berkenhout, 1769)***

**ABSTRACT**

*One disadvantage of a common method for treating breast cancer is that it causes side effects. To overcome the side effects that arise, an alternative method is developed, namely electric field therapy. Static electric fields with medium frequency can inhibit the proliferation of cancer cells. Breast cancer that expresses ErbB2 or HER2 protein indicates an aggressive and invasive condition. On the One disadvantage of a common method for treating breast cancer is that it causes side effects. To overcome the side effects that arise, an alternative method is developed, namely electric field therapy. Static electric fields with medium frequency can inhibit the proliferation of cancer cells. Breast cancer that expresses ErbB2 or HER2 protein indicates an aggressive and invasive condition. On the other hand, cancer cells can trigger innate immune cells namely macrophages which can be anti-inflammatory and proinflammatory. This study aims to determine the effect of static electric field (150 kHz and 18 Vpp) on the development of cancer cells with biomarkers of ErbB2 and infiltration of CD68 macrophages in cancerous tissue. The model animals used were rats induced with 7,12-Dimethylbenz [A] Anthracene (DMBA). This study used 4 treatments including non-induction non-therapy (NINT), non-induction therapy (NIT), induction-non-therapeutic groups. (INT) and Induction-therapy (IT) using an ECCT (Electro-Capacitive Cancer Therapy) cage, with repetitions of 6 rats of the induction group treatment after tumor nodules appear with a diameter around 1 cm. The growth of tumor types, ErbB2 positive cancer cell types, and the infiltration of macrophages CD68 along with their characteristics were observed by using hematoxylin-Eosin and immunohistochemistry staining methods. From the observation of cancer tissue growth patterns showed a diverse pattern in both treatments. The pattern that appears in the INT group shows more invasive cancers than in the IT group. The presence of ErbB 2 positive cells in the INT group were significantly more numerous (25.55%) compared to the IT group (19.43%). Result shows that the number of infiltrated-CD68 macrophages in cancerous tissue were significantly higher in therapy group ( $\pm 10.5$  cells) than in non therapy group ( $\pm 5.6$  cells). This study suggested that the static electric field (150 kHz) exposure on breast cancer induced-rats was able to reduce the number of cells expressing ErbB2 and increase CD68 macrophage infiltration in cancerou stissue.*

**Key words:** *ErbB2, rat breast cancer, static electric field, CD68 macrophage.*