

INTISARI

Gangguan penyembuhan luka sering dijumpai pada penderita Diabetes melitus. erapi *Low Intensity Pulse Ultrasound (LIPUS)* dikembangkan untuk mempercepat proses penyembuhan luka. Efek *acoustic streaming* LIPUS menyebabkan perpindahan ion intraseluler, perubahan permeabilitas membran sel dan peningkatan sifat elektrofisiologis sel. Tujuan penelitian ini untuk mengetahui pengaruh LIPUS terhadap fungsi neutrophil dan ketebalan epitel pasca eksisi kulit pada tikus model diabetes melitus tipe 2 (Penelitian Imunohistokimiawi ekspresi Matriks Metaloproteinase-9).

Tiga puluh enam ekor tikus *Sprague dawley* dibagi menjadi enam kelompok : DM2, DM4, DM7, DML2, DML4, DML7, masing-masing 6 ekor. Tikus model yang sesuai kriteria inklusi dibuat menjadi Diabetes mellitus tipe 2 dengan penyuntikan *Nicotinamide* dan *Streptozotocin*. Semua tikus dibuat luka eksisi *punch biopsy* pada punggung. Kelompok DML mendapat terapi LIPUS pada area luka (frekuensi 3 MHz, intensitas $0,5 \text{ W/cm}^2$, *duty cycle* 20 %, durasi 3 menit setiap hari selama 2 hari (DML2), 4 hari (DML4) dan 7 hari (DML7). Jaringan area luka dilakukan pemeriksaan Imunohistokimia *Polyclonal Antibody MMP-9* untuk mengamati ekspresi MMP-9 dan pewarnaan *Periodic Acid Schiff* untuk mengamati ketebalan epitel.

Hasil statistik dengan uji *Two Way ANOVA* dan *Post Hoc LSD* menunjukkan jumlah ekspresi MMP-9 pada kelompok DML lebih rendah dibandingkan kelompok DM, sedangkan ketebalan epitel pada kelompok DML lebih tinggi dibandingkan kelompok DM. Uji *Pearson* menunjukkan terdapat korelasi antara jumlah ekspresi MMP-9 dan ketebalan epitel ($p = 0,000$; $r = -0,785$). Kesimpulan : terapi LIPUS menurunkan jumlah ekspresi MMP-9 dan meningkatkan ketebalan epitel.

Kata kunci : Diabetes melitus tipe 2, *Low Intensity Pulse Ultrasound (LIPUS)*, fungsi neutrofil, ekspresi MMP-9, ketebalan epitel.

ABSTRACT

Wound healing disorders are often found in people with diabetes mellitus. Low Intensity Pulse Ultrasound (LIPUS) therapy was developed to accelerate the wound healing process. Acoustic streaming effect of LIPUS causes intracellular ion transfer, changes in cell membrane permeability and increased cell electrophysiological. The purpose of this study was to determine the effect of LIPUS on neutrophil function and epithelial thickness after skin excision in rats model diabetes mellitus type 2 (an immunohistochemical study on matrix metalloproteinase-9).

Thirty-six Sprague dawley rats were divided into six groups: DM2, DM4, DM7, DML2, DML4, DML7, each of which consist of 6 rats. Rats that matched the inclusion criteria were made into type 2 diabetes mellitus by injecting Nicotinamide and Streptozotocin. All rats were made excision wounds with punch biopsy in the back area. DML group received LIPUS therapy in the wound area (frequency 3 MHz, intensity 0.5 W/cm², duty cycle 20%, duration 3 minutes every day) for two days (DML2), four days (DML4) and seven days (DML7). Wound tissue was carried out immunohistochemical examination with Polyclonal Antibody MMP-9 to observe MMP-9 expression and Periodic Acid Schiff staining to observe epithelial thickness.

Statistical results with the Two Way ANOVA and Post Hoc LSD test showed the number of MMP-9 expressions in the DML group was lower than in the DM group, whereas the epithelial thickness in the DML group was higher than in the DM group. The Pearson test showed a correlation between the number of MMP-9 expressions and epithelial thickness ($p=0,000$; $r=-0.785$). Conclusion: LIPUS therapy reduced MMP-9 expression and increases epithelial thickness.

Keywords: *Diabetes Mellitus type 2, Low Intensity Pulse Ultrasound (LIPUS), neutrophil function, MMP-9 expression, epithelial thickness.*