Abstract

Negative pressure wound therapy (NPWT) has emerged as an attractive approach for the management and healing chronic ulcers. In our study we will explore the efficacy of Limited Access dressing (LAD) that is a combination of two newer forms of dressings — moist wound healing and intermittent negative pressure (30 minutes of negative suction and 3½ hours of rest i.e. no suction period; minimum 30 mmHg of negative pressure). Clinically it has been claimed to have more effective, economical and acceptable than conventional dressings but there is a lack of objective studies (histological and biochemical) to support clinical observations. Hence, it was deemed desirable to evaluate the efficacy of LAD using objective parameters in comparison to standard conservative conventional closed dressing method.

The study protocol, patient information sheet and patient consent form were approved by an Institutional Ethics Committee (IEC) Kasturba Hospital, Manipal.

The study is prospective randomized clinical trial which registered to Clinical Trials Registry-India, (Government of India) - CTRI number: CTRI/2015/01/005419.

Two hundred and fifteen patients ailing from chronic wounds were enrolled in to the study. After examining inclusion and exclusion criteria and taking written informed consent, 140 patients were randomized and assigned to the LAD group (n = 70), conventional dressing group (n = 70) by simple randomization through www.randomise.org. Out of 140 patients, 56 patients (LAD group = 30 & conventional dressing group=26) were lost follow up on day 10, remaining 84 patients granulation tissue biopsies from both groups (LAD group n = 40 and Conventional dressing group n = 44) was taken and analysed for histologic and biochemical studies. Histologically, necrotic tissue, amount of inflammatory infiltrate, angiogenesis and extracellular matrix deposition (ECM) were studied and scored by pathologist blinded to the study using standardised scale. In biochemical study, parameters such as hydroxyproline, hexosamine, total protein, and antioxidants [reduced glutathione (GSH), thiol, glutathione peroxidase (GPx), glutathione s-transferase (GST), catalase (CAT)], oxidative biomarker malondialdehyde (MDA), matrix metalloproteinase-2 (MMP-2), wound surface pH and nitric oxide (NO) were measured and compared. For histological study Mann Whitney U test and for biochemical study Student’s t test was performed to find the statistical significance between the groups.

Histological study, showed that there was a significant difference in histological score of LAD group after 10 days of treatment, median (Q1, Q3) = 3 (2, 4.25) versus 2 (1.75, 4); P = 0.008) and showed comparatively fewer inflammatory cells, increased and well-organised extracellular matrix deposit, more angiogenesis in LAD group as compared with that in conventional dressing group.

Biochemical Study showed that the patients treated with LAD have shown significant increase in the mean levels of (±SD) hydroxyproline (P = 0.001.), hexosamine (P = 0.047),
total protein \( (P = 0.013) \), GSH \( (P = 0.035) \), GPx \( (P = 0.003) \), GST \( (P = 0.023) \), CAT \( (P = 0.068) \), Thiol \( (P = 0.285) \), Nitric oxide level \( (P = 0.019) \), and decrease in MDA \( (P = 0.006) \), MMP-2 activity \( (P = 0.046) \) and Wound surface pH \( (P = 0.048) \).

Correlation study on day 10 in LAD group between hydroxyproline and MMP-2 shown significant negative correlation \( (r = -0.329; P = 0.033) \) but in conventional dressing group it was not significant \( (r = 0.88; P = 0.579) \). Between GSH and MDA in LAD group on day 10 revealed a negative correlation but not statistically significant \( (r = -0.279; P = 0.074) \). In conventional dressing group on day 10 revealed no significant correlation \( (r = 0.125; P = 0.429) \).

Between wound surface pH and MMP-2 on day 10 in LAD group revealed a significant positive correlation \( (r = 0.344; P = 0.026) \), conventional dressing group revealed no significant correlation \( (r = -0.110; P = 0.486) \).

The result of all the parameters and their correlation studies provides objective evidences supporting earlier observations by clinicians. To conclude, LAD exerts its beneficial effects on wound healing by increasing extracellular matrix deposition, angiogenesis, decreasing necrotic tissue and amount of inflammatory infiltrate, and reducing oxidative stress, matrix metalloproteinase [MMP-2] by providing the optimal wound pH.