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Original Research Article

# A Comparative Study to See Efficacy of Local Insulin Dressing Over Normal Saline Dressing in Diabetic Ulcer of Grade 1 and Grade 2 of Wagners Classification in Type 2 Diabetes Mellitus"

**Bipin Mishra[1], Vishakha Iyer[2], Sarojini Jadhav[3]**

[1]Resident, Department of General Surgery, G. M. C. Aurangabad.
[2]Assisstant Professor, Department of General Surgery, G. M. C. Aurangabad
[3]Professor and Head, Department of General Surgery, G. M. C. Aurangabad

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**Corresponding author: Dr. Vishakha Iyer**
**Conflict of interest: Nil**

**Abstract:**

**Introduction:** DFUs are one of the most common complications of diabetes and are a significant cause of morbidity and mortality, especially in older individuals. The prevalence of DFUs is estimated to be between 4% and 10% in patients with diabetes. The management of DFUs is complex, and several treatment modalities have been developed to accelerate wound healing and prevent complications. Several studies have reported the effective- ness of local insulin dressings in accelerating wound healing in diabetic ulcers. However, the use of normal saline dressings is a conventional method of wound care and has been shown to be effective in promoting wound healing and preventing infections. This study is done to investigatewhether topical insulin application has any role at all in the process of wound healing and if so to what degree it influences the outcome. This would provide a clinically beneficial and economically effective method to accelerate the process of wound healing.

**Methods:** In the present study, 60 cases were studied comparing the wound dressings of the patient with Topical Insulin and the Normal saline dressing in Wagners grade 1 and 2 of type 2 diabetic wounds.

**Results:** The Local Insulin Dressing group had a faster reduction in ulcer sizes with significant reduction in ulcer size in the second week and statistically significant higher difference in third week. The average number of days required for healing was significantly higher in the Normal Saline Dressing group. The percentage of granulation tissue increased significantly in the Local Insulin Dressing group at 2nd week ($p=0.01$), 3rd week ($p<0.01$). The average Pain Numerical scale decreased significantly in both groups from the baseline in each week.

**Conclusion:** The use of topical insulin was studied in terms of duration required for healing, decrease in ulcers size, appearance and coverage of granulation tissues, pain scale, microflora study and systemic hypoglycaemic effects and it was found to be safe andeffective in patients with diabetic Ulcers. The results showed that topically applied insulin promotes granulation tissue and accelerates wound healing without any systemic side effects.

**Keywords:** Diabetes, Diabetic Foot, Insulin, Normal Saline, Ulcer.



## Introduction

Diabetes mellitus is a chronic metabolic disorder that affects millions of people world-wide, and it is associated with numerous complications, including diabetic foot ulcers (DFUs) [1]. DFUs are one of the most common complications of diabetes and are a significant cause of morbidity and mortality, especially in older individuals [2]. The prevalence of DFUs is estimated to be between 4% and 10% in patients with diabetes [3]. The management of DFUs is complex, and several treatment modalities have been developed to accelerate wound healing and prevent complications [4].

One such treatment modality is the use of local insulin dressings. Insulin has been foundto have a significant role in wound healing and is known to stimulate angiogenesis, collagen synthesis, and fibroblast proliferation [5]. Several studies have reported the effective- ness of local insulin dressings in accelerating wound healing in diabetic ulcers [6,7].

However, the use of normal saline dressings is a conventional method of wound care and has been shown to be effective in promoting wound healing and preventing infections [8]. Thus, a comparison of the effectiveness of local insulin dressings and normalsaline dressings in the management of DUs is warranted.

Insulin plays an undeniable part in the healing process of wound. However, it remains unknown whether topical insulin application could help regulate the traumatic inflammatory response, and if so, whether this insulin-regulated inflammatory was one of the underlying mechanisms of accelerated wound healing. This study is done to investigate whether topical insulin application has any role at all in the process of wound healing and if so to what degree it influences the outcome. This would provide a clinically beneficial and economically effective method to accelerate the process of wound healing.

This comparative study was conducted at a tertiary care centre on Wagner grade 1 and 2 diabetic wounds. The patients were divided in two groups to receive either Local Insulin Dressing or Normal Saline Dressing and each group consisted of 30 subjects with the aim to compare the effectiveness of local insulin dressing versus normal salinedressing in the management of diabetic ulcers. We hypothesize that local insulin dressings were more effective than normal saline dressings for healing of wounds in a case ofDiabetic ulcers.

**Material and Methods:**

The present Prospective Comparative study was carried out at a tertiary care centre in a government set up over a period of two year. The study was conducted on all 60 diagnosed patients of diabetic ulcers admittedin tertiary care center were screened and those willing to participate in study were enrolled in the study.

**Inclusion Criteria:** Diabetic ulcers in type 2 diabetes mellitus, Age > 18 years, Diabetic ulcers size ranging from 5 to 15 cm, Grade I and Grade II ulcers of Wagner's classification, Controlled blood glucose level on oral hypoglycaemic agents or injectable hy poglycaemic agents, Patients giving consent to participate in the study voluntarily who were admitted for treatment of diabetic ulcer were included in the study.

**Exclusion Criteria:** Type 1 diabetes mellitus patients, Age < 18 years, Diabetic ulcers size < 5cm and > 15 cm, Patients not willing to give consent, Grade III, Grade IV and Grade V ulcers of Wagner's classification, Patient with osteomyelitis and amputation stump.

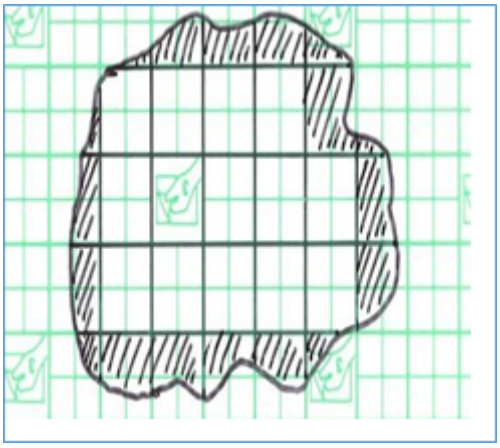
**Withdrawal / Discontinuation Criteria(s):** Patients who died during the course of treatment, Patients not willing to give consent for further treatment or study, Patients who develop complications such as abscess, sepsis and osteomyelitis.

**Screening Procedure and Format:** Detailed history of patients, Clinical Examination, Blood investigations - Routine hemogram, fasting blood sugar, postprandialblood sugar, LFT, KFT, urine routine & microscopy and Radiological investigations - (Chest x-ray PA view, X-ray local).

After screening, eligible candidates were informed regarding both procedures and the study design and dressing agents. Willingpatients were recruited in the study after obtaining proper valid consent. The study group comprised of 60 patients. Then patients were divided to either **TEST GROUP** (Insulin dressing group) or **CONTROL GROUP** (normal saline dressing group)alternatively. 2 groups were made one for insulin dressing and other for saline dressing and first enrolled patient was given group according to chit system and further all patients were enrolled alternatively to alternate group. Insulin dressings – 30 and Normal saline dressings – 30 had equal patients.

In TEST GROUP, ulcers were cleaned with normal saline and then irrigated with 4 units of human soluble insulin for each 10 $cm^2$ of wounds. 4 units of human insulin wassprayed on the ulcer using insulin syringe daily and then covered with sterile cotton gauzes.

In CONTROL GROUP, ulcers were cleaned with normal saline without using local insulin and covered with sterile cotton gauzes. At the start of study, wound features (ulcer size, amount of slough and amount of slough), observed and recorded. Dressing was done daily regularly irrespective of soakage. And wound evaluated weekly for above mentioned wound features. And findings noted. Wound swabs sent weekly and antibiotics are started accordingly. Pain was assessed using Numerical pain scale. Ulcer size and granulation tissue was measured using graph paper in $cm^2$.



Firstly, count the number of whole squares and convert the incomplete squares into whole ones (i.e. there may be 4 small pieces that together would make a complete cm²).Add this number to your number of whole squares to give a total surface area figure in cm². This will give us baseline surface area. Then retrace the wound weekly which willprovide us new surface area. We calculated the reduction in size using following formula

**Percentage size reduction = 1- current surface area/ previous surface area [1=100%]**

Which represented the area of wound size reduction (% reduction in ulcer size since the last measurement. Random blood glucose levels (BSL) was measured with a glucometer 10 minutes be- fore and 30 minutes after application of topical insulin in both groups to see any hypoglycaemic effects.

- **Pain Assessment**


**Figure 1: Numerical pain scale**

**Ethical Considerations and Issues:** Study was approved from the IEC / IRB (Institutional Ethical /Review Board) be-fore starting the study.

**Statistical Analysis Details:**

Data was entered into Microsoft excel data sheet and was. Analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions.

**Chi-square test or Fischer's exact test** (for 2x2 tables only) was used as test of significance for qualitative data.

**Statistical software:** MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyse data.

**Observations and Results:**

A Comparative study was conducted over 60 patients (19 females, 41 males) at a tertiary care center on Wagner grade 1 and 2diabetic wounds. The patients were randomized in order to receive either Local InsulinDressing or Normal Saline Dressing and each group consisted of 30 subjects. The observations and results of the study are presented as follows.

**Table 1: Average age comparison between study groups.**

| Intervention Group | | Age | P |
|---|---|---|---|
| Local Insulin Dressing (N=30) | Mean | 54.1 | 0.92 |
| | SD | 12.3 | |
| Normal Saline Dressing (N=30) | Mean | 53.8 | |
| | SD | 10.9 | |
| Total | Mean | 54.0 | |
| | SD | 11.5 | |

Table no.1 shows that in Local Insulin Dressing group, the average age of cases was 54.1± 12.3 years whereasit was 53.8± 12 years in Normal Saline Dressing group. Average age difference betweenthe groups was non-significant. (p>0.05)

**Table 2: Average comparison of ulcer size at baseline**

| Intervention Group | | Ulcer size atbaseline (cm) | P |
|---|---|---|---|
| Local Insulin Dressing (N=30) | Mean | 10.6 | 0.18 |
| | SD | 2.3 | |
| | Median | 10.0 | |
| Normal Saline Dressing(N=30) | Mean | 11.5 | |
| | SD | 2.5 | |
| | Median | 10.5 | |
| Total | hm | 11.1 | |
| | SD | 2.4 | |
| | Median | 10.0 | |

Table no.2 shows that in Normal Saline Dressing group, the average size of ulcer was 11.5± 2.5 cms, whereasit was 10.6± 2.3 cms in Local Insulin Dressing group. Average size of ulcer between the groups was comparable. (p>0.05)

**Table 3: Mean PAIN NUMERICAL SCALE Score over the study period in Normal saline group**

| Pain Numerical Scale | | Mean | SD | P |
|---|---|---|---|---|
| Pair 1 | baseline | 4.10 | 0.48 | <0.0001 |
| | 1st week | 2.97 | 0.56 | |
| Pair 2 | baseline | 4.10 | 0.48 | <0.0001 |
| | 2nd week | 1.47 | 1.01 | |
| Pair 3 | baseline | 4.10 | 0.48 | <0.0001 |
| | 3rd week | 0.13 | 0.43 | |
| Pair 4 | baseline | 4.10 | 0.48 | <0.0001 |
| | 4th week | 0.00 | 0.00 | |

Table no.3 shows that in Normal saline group too, there was consistent fall in average PAIN NUMERICAL SCALE from the baseline in each week and the mean difference was highly significantcompared to baseline.

**Table 4: Average PAIN NUMERICAL SCALE score in Local Insulin Dressing Group**

| Pain Numerical Scale | | Mean | SD | P |
|---|---|---|---|---|
| Pair 1 | baseline | 3.70 | 0.75 | <0.0001 |
| | 1st week | 2.63 | 0.56 | |
| Pair 2 | baseline | 3.70 | 0.75 | 0.003 |
| | 2nd week | 1.40 | 0.67 | |
| Pair 3 | baseline | 3.70 | 0.75 | 0.003 |
| | 3rd week | 0.20 | 0.2 | |
| Pair 4 | baseline | 3.70 | 0.75 | <0.0001 |
| | 4th week | 0.00 | 0.00 | |

In Insulin group there was consistent fall in average PAIN NUMERICAL SCALE fromthe baseline in each week

and the mean difference was highly significant compared tobaseline.

**Table 5: Comparison of Incidence of Positive Culture for Bacteria in study groups**

| Positive Culturefor Bacteria | | Intervention Group | | Total | P |
|---|---|---|---|---|---|
| | | Local Insulin Dressing (N=30) | Normal Saline Dressing(N=30) | | |
| Baseline | Number | 9 | 7 | 16 | 0.546 |
| | % | 30.00% | 23.33% | 26.67% | |
| Week 1 | Number | 7 | 7 | 14 | 1 |
| | % | 23.33% | 23.33% | 23.33% | |
| Week 2 | Number | 4 | 6 | 7 | 0.453 |
| | % | 13.33% | 20.00% | 11.67% | |
| Week 3 | Number | 0 | 0 | 0 | na |
| | % | 0.00% | 0.00% | 0.00% | |
| Week 4 | Number | 0 | 0 | 0 | na |
| | % | 0.00% | 0.00% | 0.00% | |

Table no.5 shows that at baseline 30% cases in Insulin group had positive bacterial cultures and 23.3% positive cultures in NS group. At week 1, the positivity reduced to 23.3% in insulin group but remained same as baseline in NS group. In week 2 there were only 13.3 % positive cultures in insulin but 20% in NS group. Atweek 3 and 4 all cultures were sterile.

**Table 6: Appearance of granulation tissues (mean %) comparison between studygroups**

| | | Mean | Std. Deviation | P |
|---|---|---|---|---|
| Granulation tissue (%) 1st week | Local Insulin Dressing | 17.8333 | 9.62068 | 0.17300 |
| | Normal Saline Dressing | 14.8333 | 7.00780 | |
| Granulation tissue (%) 2nd week | Local Insulin Dressing | 43.8333 | 15.35125 | 0.01* |
| | Normal Saline Dressing | 34.8333 | 10.04158 | |
| Granulation tissue (%) 3rdweek | Local Insulin Dressing | 73.1667 | 14.99904 | 0.002** |
| | Normal Saline Dressing | 61.5000 | 13.46451 | |
| Granulation tissue (%) 4thweek | Local Insulin Dressing | 88.0000 | 20.74475 | 0.086 |
| | Normal Saline Dressing | 80.1667 | 13.22767 | |

Table no.4 shows that appearance of Granulation tissue (%) in 1st week was comparable between the groups. (p>0.05). Appearance of Granulation tissue (%) in 2nd week was significantly higher in insulin group (p=0.01). Granulation tissue (%) in 3rd week was significantly higher in insulin group compared to normal saline(p<0.01). In 4th week as well the Granulation tissue (%) was higher in insulin group, however the difference was not statistically significant compared to normal saline. (p>0.05)

**Table 7: % Reduction in ulcer size over the Study Period**

| Intervention Group | | % Reduction in ulcer size 1st Week | % Reduction in ulcer size 2nd week | % Reduction in ulcer size 3rd Week | % Reduction in ulcer size 4th Week |
|---|---|---|---|---|---|
| Local Insulin Dressing(N=30) | Mean | 19.63 | 45.47 | 69.42 | 86.88 |
| | SD | 7.15 | 13.94 | 18.06 | 18.16 |
| | Median | 20.00 | 45.50 | 72.05 | 95.45 |
| Normal Saline Dressing(N=30) | Mean | 18.47 | 36.72 | 52.90 | 67.65 |
| | SD | 7.49 | 8.86 | 12.40 | 14.45 |
| | Median | 16.70 | 33.30 | 50.00 | 70.00 |
| Total | Mean | 19.05 | 41.09 | 61.16 | 77.27 |
| | SD | 7.28 | 12.39 | 17.47 | 18.94 |
| | Median | 20.00 | 40.00 | 62.50 | 77.35 |
| | | 0.54 | 0.003 | <0.0001 | <0.0001 |

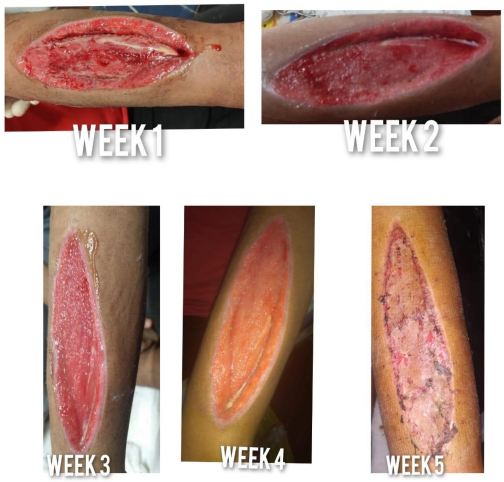
Table no.6 shows that in Local Insulin Dressing group, the average % reduction in ulcer size during the first week was 19.63 ±7.15, compared to 18.47±7.5 in Normal Saline Dressing group, which was comparable. (p>0.05) In the second week, the average % reduction in ulcer size was 45.47 ±13.9 in Local Insulin Dressing group and 36.7±8.9 in Normal Saline Dressing group. The differencewas

highly significant. (p<0.01) In the third week, the ulcer size was reduced by average % value of 69.42±18.1 in Local Insulin Dressing group and 52.90±12.4 in Normal Saline Dressing group. The differ- ence was highly significant. (p<0.0001) The average reduction percentage in the fourth week was 86.88±18.2 in Local Insulin Dressing group and 67.65±14.5 in Normal Saline Dressing group. The difference was highly significant. (p<0.0001)

**Table 8: Average Number of days required for healing**

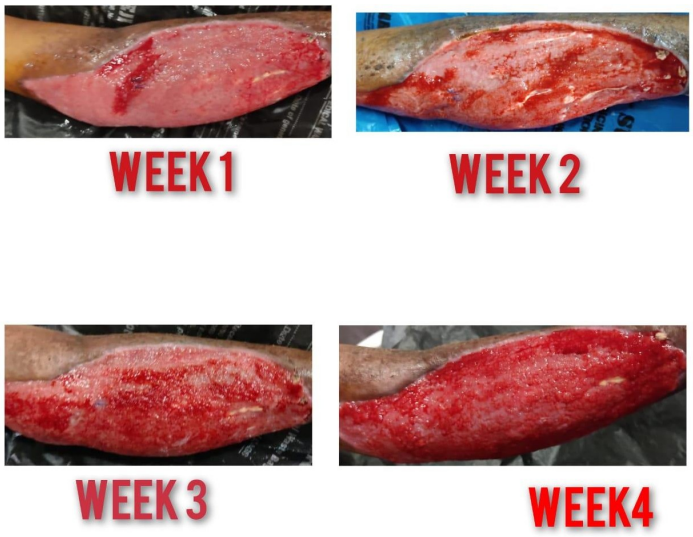
| No. of days for healing | No. of days required for healing | | | P |
|---|---|---|---|---|
| | Mean | SD | Median | |
| Local InsulinDressing (N=30) | 32.63 | 9.54 | 30.00 | |
| Normal SalineDressing (N=30) | 44.07 | 11.69 | 40.00 | |
| Total | 38.35 | 12.04 | 35.00 | <0.001 |

Table no.7 shows that the average number of days needed for healing were significantly higher (44.07±11.7days) in Normal Saline Dressing group as compared to Local Insulin Dressing group (32.63 ±9.5 days. (p<0.001)




**Insulin Dressing**

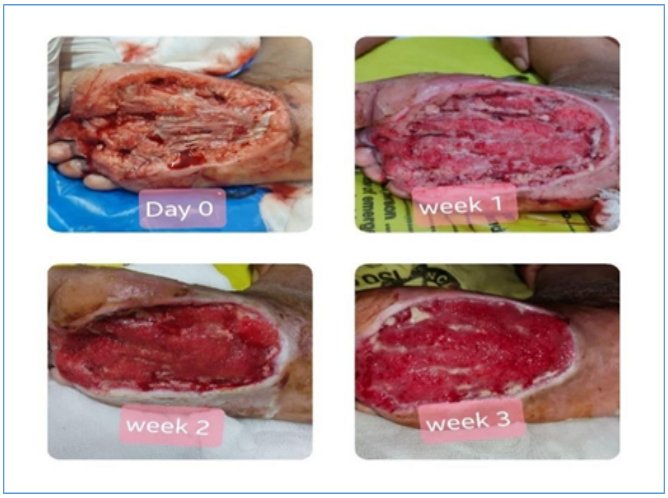
Patient had right leg cellulitis in a k/c/o DM for which release incision was takenand further insulin dressing done regularly on wound and granulation tissues ap-pears earlier but wound remains uncovered and hence SSG done



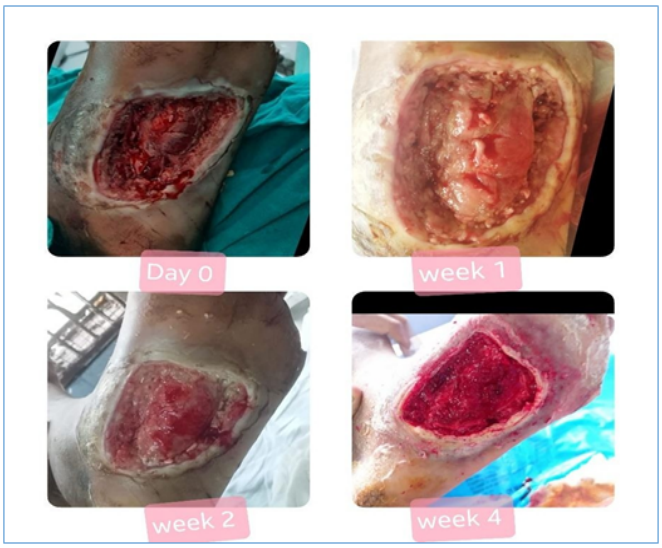

**Normal Saline Dressing**

Patient in a k/c/o DM & develop left upper limb cellulitis post thorn prick injury and debridement done following which regular normal saline dressing and woundhealing started with late appearance of granulation tissue and afterwards SSG is done

- **Insulin Dressing**




**-Normal Saline Dressing**




**Discussion**

Since Banting's discovery of Insulin in 1921, many benefits beyond blood glucose regulation have been documented. In the early 20th century, insulin was widely used for purposes other than treating diabetes, but this practice was forgotten in the 1940s and 1950s. However, interest in using insulin for non-diabetic purposes was renewed in the latter part of the century. [9]

Human diabetic wounds were treated with insulin in the 1960s, and more recently, insulin spray has been used successfully to treat patients with diabetic ulcers. Moreover, this hormone has been successfully used to treat burns in humans and animals. The fundamental processes of insulin-induced enhanced healing are not fully known, despite the significant evidence that it accelerates healing and speeds up wound closure. [10]

In our study, there was male preponderance with 73.3% and 63.3 % males respectively in local insulin group and normal saline group while female distributionwas 26.7% and 36.7% respectively in local insulin group and normal saline group.

In Local Insulin Dressing group, the average age of cases was 54.1± 12.3 years whereas it was 53.8± 12 years in Normal Saline Dressing group. Averageage difference between the groups was non-significant. The age and gender distribution was comparable to the study conducted by Singh M. et al [66] who observed the mean age to be 57.84 years and it comprised of 37(74%) males and 13 (26%) females and similarly the age and gender distribution was comparable in most of the other studies.

In the present study it was found that the average number of days needed for healing was higher (44.07±11.7 days) in Normal Saline Dressing group as compared to Local Insulin Dressing group (32.63 ±9.5 days. This data was found to be statistically

significant($p<0.001$).

Similar results are found in study of Goenka et al [11] where it was found that no. of days required for healing was 38 ± 17.03 days in Group A1(Diabetic on Insulin dressing) and 44.3 ± 17.5 days in Group B1(Diabetic on NS dressing). Whereas number of days required for healing was 30.5 ± 13 days in Group A2 (Non-Diabetic on Insulin dressing) and 40 ± 18.8 days in Group B2 (Non-Diabetic on NS dressing) which suggests superiority of insulin dressing in diabetic as well as non-diabetic wounds when healingperiod was considered.

Also, Van Ort and Gerber [6] through their pilot study stated that the effect of topical insulin on decubitus ulcers reported significant difference in wound healing rate between the treatment and control groups bythe 15th day.

It was also studied over animals such as study done by Wang J et al [5]who presented a review of Animal and Human studies' evidences that topical Insulin induces rapid recovery of various wounds in diabetic andnon-diabetic cases.

In the present study baseline average wound length was 11.5 cm in NS group and 10.6 cm in Local Insulin Dressing group, average wound breadth was 6.67cm in NS and 6.17 cm in Local Insulin group whereas average depth was 2.17 cm and 2.03 cm in NS and Insulin groups respectively. Average wound length,breadth and depth between the groups were comparable.

We compared the average % reduction in ulcer size during the first week it was 19.63 ±7.15, compared to 18.47±7.5 in Insulin Vs NS group, which was comparable. ($p>0.05$).

In the second week the average % reduction in ulcer size was 45.47 ±13.9 Vs. 36.7±8.9 Insulin Vs NS group and the difference was significant ($p<0.01$) which further improved to 69.42±18.1 Vs. 52.90±12.4 in the third week where the difference was highly significant ($p<0.0001$). Finally in the fourth week average % reduction was 86.88±18.2 Vs 67.65±14.5 in Insulin Vs NS group. The difference was highly significant. ($p<0.000$) The trend was clearly suggestive of better efficacy of Insulin over NS in every week in terms of reduction in wound size.

Similarly, study done by Rezvani O et al [7] reported that the mean rate of healing rate was 46.09 mm2/day in the Insulin group and 32.24 mm2/day in the control group ($P = 0.029$), independent of baseline wound size.

Even Stephen S et al [12] in their placebo controlled RCT in non-diabetic pressure ulcers reported that by day 7, mean wound area had decreased from 11.79 ± 8.97 cm2 (day 1) to 11.43 ± 9.06 cm2 in the saline group ($P = 0.566$) and from 9.61 ± 6.39 cm2 (day 1) to 6.24 ± 4.33 cm2 (P less than 0.01) in the insulin group which suggests that treatment with topical insulin was found be effectivein reducing pressure ulcer size as compared to normal saline-soaked gauze.

When we study wound healing in our study with relation to granulation tissue coverage it was found out that the appearance of average Granulation tissue (%)in 1st week was comparable between the groups. At the endof 1st week appearance of granulation tissues in both groups were not statistically significant but they were comparable ($p>0.05$).

Appearance of average Granulation tissue (%) in 2nd week was significantly higher in insulin group ($p=0.01$) which further improved in 3rd week ($p<0.01$). In 4th week as well the average granulation tissue (%) was higher ininsulin group, however the difference was not statistically significant compared to normal saline. ($p>0.05$). It states that application of topical insulin accelerates granulation tissues and promote wound healing.

Similarly, studies done by Martinez-Jimenez MA and Aguilar-Garcia J et al [13] and of Martinez-Jimenez MA and Valadez-Castillo FJ [14] and both of these studies have found significant differences in the number of vessels on the insulin-treated side (96 ± 47) when compared with the no-insulin side and fibrosis is seen more on insulin treated side. Thus, granulation coverage over wound is seen faster on wound with insulin dressing.

Other study of Thakur et al [15] also stated that Average time required for granulation tissue to appear (Mean±SD) was significantly less in group A of insulindressing as compared to group B of saline dressing i.e. 5.68±2.45 and 11.24±3.29 ($p<0.001$) and it was statistically significant difference.

In our study, in both Insulin as well as normal saline group there was consistent fall in average Pain Numerical Scale from the baseline in each week and the mean difference was highly significant compared to baseline. Similarly, Rezvani O et al [7] and most of the other studies reported vey insignificant pain in patients within both groups and Sarabahi et al [16] observed that topical insulin application accelerated wound healing by causing

reduced loss of proteins, electrolytes and fluid from the wound which help to minimizepain and infection in the wounds.

In the present study at baseline 30% cases in Insulin group had positive bacterial cultures and 23.3% positive cultures in NS group. At week 1 the positivity reduced to 23.3% in insulin group but remainedsame as baseline in NS group. In week 2 there were only 13.3 % positive cultures in insulin but 20% inNS group. At week 3 and 4 all cultures were sterile.

The growth of microflora in both groups was comparable in both groups in allthe weeks ($p>0.05$) This suggest no significant impact of Insulin on controlling infections. The most common isolates were Staphylococcus aureus, Klebsiella and E coli. The findings of our study were similar to Indian study by Ramarao K et al [17] who reported that the wound culture on day 14 was negative in73.33% patientsin group A compared 56.67% in group B.

They also found no statistically significant difference between the two groups ($p=0.176$). The most common isolate on day 14 was P. vulgaris in group B (33.33%) and in group A it was E. Coli and P.vulgaris (25%).

When we study the safety of topical insulin in terms of hypoglycaemia it is found that the mean BSL average was more before dressing in both the groups as compared to after dressing. Mean BSL average after dressing was comparable between both the groups however it was significantly lower in Insulin group (112.60 ± 17.25 mg/ dl) compared to normal saline group (121.17 ± 13.99 mg/dl) ($p<0.001$). Although there was reduction in average glucose values there was no event of hypoglycaemia in either of the groups.

Studies supporting above findings are Rezvani O et al [7] twice-daily topicalapplication (spray) of 1 cc saline 0.9% for each 10 cm2 of wound with or without 10 units (0.1 cc) of insulin crystal and insulin reported no patients developed signs or symptoms of hypoglycemia and glucose levels pre- and post- application did not differ significantly.

Similarly, Sun S et al [18] also reported that there was no event of hypoglycaemia due to insulin.

Strength of study: Not many studies are there to see efficacy of local insulinover normal saline in terms of all above discussed objectives.

**Weakness of study**

**a)** Though insulin accelerates wound healing but process is cumbersome

**b)** When insulin dressing is compared with normal saline dressing it is found to be superior but it is not recommended in routine as it needs to be compared with other agents of routine dressing also.

**Conclusion:**

We can conclude that the use of topical insulin was studied in terms of duration required for healing, decrease in ulcers size, appearance and coverage of granulation tissues, pain scale, microflora study and systemic hypoglycaemic effects and it was found to be safe and effective in patients with diabetic Ulcers. The results showed that topically applied insulin promotes granulation tissue and accelerates wound healing without any systemic side effects.

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