

Analytical Study of Various Dressing in the Management of Diabetic Foot

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ABSTRACT

Introduction: Diabetes is a physiological disorder that can modify many physiological functions if not managed properly. Prolonged diabetic ulcer is one of the most significant side effects of diabetes due to impairment of vascular network at the wound sites. The study was carried out in patients admitted in Sree Balaji Medical college and Hospital, Chennai from December 2015 to October 2016.

Methods: The patients were allocated randomly into four groups – Group A, Group B, Group C and Group D which corresponded to saline, povidone-iodine, metronidazole, and eusol dressing respectively and their demographic data were collected.

Results: The study showed that non curable ulcer risk increased with aging at 50-60 years and severity and duration were higher in male than females. Smoking and alcoholism contribute dangerously affect the diabetic ulcers. The familial history played a significant role in ulcer management. The antibiotics showed effective results within the groups. But the comparative analysis between the groups resulted in non- significant results.

Conclusion: The present study showed that strategic and continuous management of ulcers for effective therapeutic goals irrespective of combination of the antibiotics.

Key words: Diabetes, Ulcer, Comparative analysis, Antibiotic resistance, Ulcer management

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INTRODUCTION

The increasing prevalence of diabetes in human brings many complications in their lifetime and the diabetic foot ulcer is one of them [1]. Diabetics constantly impair the physiological signaling and vascular network is being the main system affected by the onset of diabetics even at early ages. This hyperglycemia could be of micro vascular complications (such as nephropathy, neuropathy, and retinopathy) and macrovascular complications (such as coronary artery disease, stroke and peripheral arterial disease) [2]. Diabetes increases the risk of producing non-curable ulcer as 15% in individuals and remains as the leading cause for non- traumatic amputation. The diabetic ulcers need effective management unless they may result in amputations [3-29].

The aim of the present study is to study the age and sex incidence in diabetic patients, to analyse the average duration for the development of foot ulcer and to evaluate the outcome of various dressings in management of diabetic foot among the patients with diabetic foot ulcer. The study was carried out in patients admitted in Sree Balaji Medical college and Hospital, Chennai from December 2015 to October 2016.

MATERIALS AND METHODS

Inclusion criteria

All patients were classified according to depth ischemia classification. Patients in grade–Depth 0, 1, 2, 3 and ischemia A were included in the study. Appearance of healthy granulation tissue in the floor of the ulcer is taken as the end point for observation (Table 1).

About 80 patients were included in the study. These patients were allocated randomly into four groups – Group A, Group B, Group C and Group D

Table 1: "The depth-ischmeia" classification of foot lesions.

Depth Classification and Definition	
0	The "at-risk" foot: previous ulcer or neuropathy with deformity that may cause new ulceration
1	Superficial ulceration, not affected
2	Deep ulceration exposing a tendon or joint (with or without specific infection)
3	Extensive ulceration with exposed bone and/or deep infection (i.e., osteomyelitis or abscess)
Ischemia Classification and Definition	
A	Not Ischemic
B	Ischemia without gangrene
C	Partial (forefoot) gangrene of the foot
D	Complete foot gangrene

Table 2: Study group.

Grading	Group A-Saline dressing	Group B-Povidone iodine dressing	Group C-Metronidazole dressing	Group D-Eusol dressing
1A	3	4	3	4
2A	13	11	12	12
3A	5	4	5	4
Total	21	19	20	20

Table 3: Time interval Vs. grade of lesion.

Grading	Time interval in days			
	Group A	Group B	Group C	Group D
1A	18–24	2–25	17–21	20–24
2A	26–31	20–32	28–35	27–32
3A	41–54	46–53	39–48	43–54

which corresponded to saline, povidone-iodine, metronidazole, and eusol dressing respectively (Tables 2 and 3). Detailed history about the onset of diabetes, regularity of treatment (whether on OHA or Insulin) and follow up were elucidated. Detailed history about the present lesion – mode of onset and its progression were recorded. Detailed general examination and local examination were carried out in all patients and recorded. All patients underwent daily surgical wound debridement and daily dressing. All patients were given adequate bed rest.

RESULTS

Initially 108 patients were recruited for this study. About 80 patients were included in the study. 53 patients were male and 27 were female. 28 patients were excluded because during the course of their stay in hospital they either absconded or expired or went against medical advice. The study showed that risk non curable ulceration may start at 50-60 years (Table 4). mean (\pm SD) age of the participants was 53.52 ± 10.8 years. Of all cases, 53 (66%) were male and 27 (33%) and the results revealed that the male patients had more chances getting ulcers than female (Table 5). In our study, 62% of the patients had a positive history of diabetes mellitus. Rest, 38% of patients had no history of

Table 4: Age incidence in diabetic ulcer patients.

Age Group in years	Male	Female	Male %	Female %
20–30	Nil	Nil	Nil	Nil
31–40	4	1	8%	4%
41–50	13	9	25%	33%
51–60	22	11	42%	41%
61–70	11	5	20%	19%
71–80	3	1	5%	3%
Total	53	27	100%	100%

Table 5: Sex incidence in diabetic ulcer patients.

	No. of cases	Percentage
Male	53	66%
Female	27	34%
Total	80	100%

diabetes mellitus or who did not have knowledge about history of DM (Table 6). The duration of ulcer was longer in males than female patients (Table 7). 40% of males, in this study, suffered more than 10 years and 60% were for at least 5 years. Meanwhile, only, 20% the female patients had wound history for 10 years.

The diabetic ulcer required proper and regular management. In our study, the patients who regularly cared the ulcer suffered lesser than the ones with irregular management (Table 8). The questionnaire was based on AHA and insulin level management. The study revealed the significance of ulcer management. 75% of the patients in the study were used the physical exercises to manage

Table 6: Family history in diabetic ulcer patients.

	No. of cases	Percentage
Present	50	62%
Absent	30	38%
Total	80	100%

Table 7: Duration of ulcer in diabetic patients.

Age in years	Male	Female	Total number of patients	Percentage
<1 yr.	1	Nil	1	1%
1-5 yrs.	5	2	7	9%
5-10 yrs.	32	16	48	60%
>10 years	15	9	24	30%

Table 8: Regular and irregular management of ulcer in diabetic patients.

	Patients on OHA	Patients on Insulin	Total no. of patients	Percentage
Irregular	42	16	58	72%
Regular	14	8	22	28%

Table 9: Regular and irregular management of ulcer in diabetic patients.

	No. of cases	Percentage
Active Work	60	75%
Sedentary Lifestyle	20	25%

the diabetes and they showed lesser severity than the sedentary ones (Table 9). Other, 25% patients showed severe ulcer complications due to the absence of physical activity. Precipitating cause was one of the significant criteria in managing diabetic complications (Table 10). 53% patients faced the ulcer by spontaneous reasons followed by accidental injury (27%). To assess the complications, we had also done the ulcer grading in diabetic patients (Table 11). 60% patients in the showed that they were in grade 2A followed by 3A (23%) and 1A (1A). 44% patients had wounds in toes followed by Metatarsal Head (36%). Table 12 showed the Non healed ulcer grading of the patients participated in the study. Table 13 shows the site of ulcer in diabetic foot. Tables 14 and 15 showed the responsibilities from the patients. Patient's responsibility is an important criterion for the progressive study. More than 70% of all groups responded positively to the study instructions. Table 16 shows the factors affecting the ulcer management in diabetic patients.

Test of significance is carried in accordance with chi-square test and test results are compared in accordance with table of test of significance. The results were compared between the groups using statistical analysis. Tables 17 and 18 summarized the results between Saline versus Povidone iodine groups. The statistical analysis showed

Table 10: Precipitating cause for ulcer in diabetic patients.

	No. of patients	Percentage
Spontaneous	42	53%
Accidental injury	22	27%
Nail cutting	12	15%
Previous lesion	4	5%

Table 11: Grading the ulcer in diabetic patients.

Grade	Male	Female	Total	Percentage
1A	9	5	14	17%
2A	32	16	48	60%
3A	12	6	18	23%
Previous lesion	4	5%		

Table 12: Grading the non-healing ulcer in diabetic patients.

Grade	Total	Percentage
1A	2	15%
2A	4	30%
3A	7	55%
Total	13	100%

Table 13: Site of Ulcer in diabetic foot.

Site	Total no. of cases	Percentage
Toes	35	44%
Metatarsal Head	29	36%
Heel	11	14%
Dorsum of foot	5	6%

Table 14: Responders Vs. Non-Responders.

	Responders	Non responders	Total
Group A	11	10	21
Group B	15	4	19
Group C	13	7	20
Group D	9	11	20
Total	48	32	80

Table 15: Outcome of non-responders.

Outcome	Total	Percentage
Toe Amputation	16	50%
Transmetatarsal Amputation	11	34%
BK Amputation	5	16%
Total	32	100%

Table 16: Factors affecting the ulcer management in diabetic patients.

Factors	Total	Percentage
Grade of Lesion	13	40%
Non-compliance of patients	10	33%
Uncontrolled Hypertension	3	9%
Hyperlipidemia	3	9%
Smoking	3	9%
Total	32	100%

the the results were not significant (Chi-Square Test = $\sum (O - E)^2/E = 3.19$). The p value (>0.05) implied that the results are not significant. The

Table 17: Saline versus povidone iodine.

Group	Responder	Non responder	Total
A	11	10	21
B	15	4	19
Total	26	14	40

Table 18: Chi-square test for saline versus povidone iodine.

	Responder	Non responder
A	O=11, E=12.6	O=10.0, E=7.7
B	O=15, E=12	O=4, E=7.4

results of Saline Vs Metronidazole comparison represented in Tables 19 and 20. Chi-Square Test implied that the results were not significant. ($t = \sum (O-E)^2/E = 0.69$, $p > 0.5$ which implied the results are not significant. Similarly, other comparison analysis between the groups was resulted in not statistically significant inferences. The results were summarized in Tables 21-28. Since the tests are not significant Null Hypothesis is proved in this chi-square test, which shows one dressing is not superior when compared to other.

Table 19: Saline Vs. metronidazole.

Group	Responder	Non responder	Total
A	11	10	21
C	13	7	20
Total	24	17	41

Table 20: Chi-square test for saline vs. metronidazole.

Group	Responder	Non responder
A	O=11, E=11.97	O=10, E=8.82
C	O=13, E=11.97	O=7, E=8.82

Table 21: Saline Vs Eusol.

Group	Responder	Non responder	Total
A	11	10	21
D	9	11	20
Total	20	21	41

Table 22: Chi-square test for saline vs. eusol (Chi-Square Test= $\sum (O - E)^2/E = 0.27$ P Value is < 0.5 which implies the results are not significant).

Group	Responder	Non responder
A	O=11, E=10.08	O=10, E=10.92
D	O=9, E=10.08	O=11, E=10.92

Table 23: Povidone Iodine Vs Metronidazole.

Group	Responder	Non responder	Total
B	15	4	19
C	13	7	20
Total	28	11	39

Table 24: Chi-square test for povidone iodine vs. metronidazole (Chi-Square Test= $\sum (O - E)^2/E = 1.26$ P Value is > 0.5 which implies the results are not significant).

Group	Responder	Non responder
B	O=15, E=13.6	O=4, E=6.4
C	O=13, E=14.28	O=8, E=6.72

Table 25: Metronidazole Vs. eusol.

Group	Responder	Non responder	Total
C	13	7	20
D	9	11	20
Total	22	18	40

Table 26: Chi-square test for metronidazole vs. eusol (Chi-Square Test= $\sum (O - E)^2/E = 1.74$, P Value is < 0.1 which implies the results are not significant).

Group	Responder	Non responder
C	O=13, E=10.92	O=7, E=10.08
D	O=9, E=10.92	O=11, E=10.08

Table 27: Povidone Iodine Vs. Eusol.

Group	Responder	Non responder	Total
B	15	4	19
D	9	11	20
Total	24	15	39

Table 28: Chi-square test for povidone iodine vs. eusol (Chi-Square Test= $\sum (O - E)^2/E = 4.6$, P Value is > 0.05 which implies the results are not significant).

Group	Responder	Non responder
B	O=15, E=11.8	O=4, E=8.2
D	O=9, E=12.39	O=11, E=8.61

DISCUSSION

In the present study, 80 patients from Sree Balaji medical college and hospital were subjected detailed history examination and basic investigations. Our study showed the male were facing more complications than female in diabetic ulcer management. There was a direct relationship between ulcer severity and aging. Rossaneis et al. [30] also showed similar result in their study. In about 62% of patient's positive family history of diabetic mellitus was present and 38% gives either no positive history or unaware about this condition. Our result was concordance with the previous study [31]. The results from the present study also implied that longer the duration of disease, poor glycemic control and physical stress have a direct correlation with the development of foot ulcer, like the previous study by Oliver et al. [32].

In those patients who developed foot ulcer about 50% did not have any antecedent cause as a precipitating event. In the rest of the group accidental trivial injury that was left uncared, nail cutting, and previous lesion were found to be the precipitating cause. Spontaneous development of foot ulcer points towards the neuropathic changes which the patient is unaware till the ulcer develops. In the affected group most common site of occurrence was toes

followed by metatarsal heads, heel, and dorsum of foot. All these indicate that the ulcer is more likely to develop in pressure areas [33]. In this study about 60% of the patients were in Grade 2A which implied patients with ulcer exposing joints and tendons without ischemia. Rest of the patients had Grade 1A or Grade 3A ulcer. Of the 80 patients participated in the study about 21 patients were allocated in Group A, 19 in Group B, 20 in Group C and 20 in Group D. All these patients were allocated randomly. Group A, B, C and D corresponded to Saline Dressing, Povidone Iodine Dressing, Metronidazole Dressing and Eusol Dressing respectively, but the results were not statistically between the groups. All the patients were subjected to daily surgical wound debridement, daily dressing and given complete bed rest with positional variation. The end point for the study was taken as appearance of healthy granulation tissue in the entire floor of ulcer.

CONCLUSION

In this study of 80 patients with diabetic foot ulcer from about 66% of the patients were male and 34% were female. Most of the patients were between 41 – 60 years of age with maximal clustering between 51 – 60 years of age. Duration of Diabetes Mellitus is an independent risk factor for the development of foot ulcer. Duration of Diabetes Mellitus for more than 5 – 10 years increase the risk of foot ulcer. Poor glycemic control and other risk factors have a direct relationship with the development of foot ulcer. Bed rest, adequate surgical wound debridement and nonirritant dressing is the mainstay of treatment of those foot ulcer without ischemia. Usage of Povidone Iodine, Eusol and Metronidazole did not offer any healing benefit when compared to normal saline dressing. Since diabetic foot has a multi factorial origin, multi-disciplinary approach with holistic view forms the backbone for the management of diabetic foot.

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ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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