

Original Research Article

Role of nano-collagen particles dressing in the management of chronic ulcer: a prospective non-randomized trial on 100 cases

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ABSTRACT

Background: Collagen has unique property of adhere to the ulcer floor thus reduces plasma oozing, bacterial colonization, pain and ulcer size which boost the process of granulation and epithelialization thus healing.

Methods: In this prospective, non-randomized study 100 patients of different age and sex having chronic ulcer situated on various parts of the body were taken. Nano collagen particles preparation “collofibre” of TNC health care was used.

Results: Most of the patients fall in their most productive life (3rd and 4th decade), restricted mobility due to pain. Thus anaemia, diabetes, old age, debility, bed ridden situations, other associated injuries and certain medical conditions contribute to delay in ulcer healing and hospital stay. Bacterial contamination, presence of necrotic tissue and slough delay the healing process. 73% of patients complain of itching and burning sensation after application otherwise no major side effect detected.

Conclusions: Use of nano collagen particles dressing accelerate the healing process in chronic ulcers.

Keywords: Chronic ulcer, Dressing, Nano collagen particles

INTRODUCTION

An ulcer is defined as a breach in the continuity of covering epithelium i.e., skin or mucous membrane as a result of molecular death whereas a “chronic ulcer is defined as a gradual breakdown of the epidermal and dermal tissue of the body lasting for more than 12 weeks.^{1,2} In human regeneration and regrow of tissue is only found in epithelium and liver, other tissues of the body heal by repair with scar formation. Collagen is triple helix protein and its unit is febrile, which not only for extracellular dermal matrix (ECM) as major part but all organ and system require collagenous structures. Collagen is mainly synthesized by fibroblast. About 21 distinct collagens have been identified till date, out of

which 6 are present in skin. Collagen account for approximately 80% of dry weight of skin. Collagen type I accounts 70%, III about 10% and rest in traces.^{3,4} Collagen has a key role in control of inflammatory response by synthesis of cytokines to injury and subsequent repair, ECM protein synthesis and remodeling or in other way angiogenesis, fibroplasias, epithelialization, contraction, remodeling and scar formation, which increases tensile strength of the wound, which is 20% by 3 weeks and a maximum of 70% of normal skin at completion of healing process means a scar always remain weaker than its normal skin.³⁻⁵ In chronic ulcer there is a breach in normal healing process due to debility, local reasons like infections, PVD, diabetes mellitus, hypoxia, anaemia, hypoperfusion,

steroids, chemotherapy etc. when collagen dressings are used in chronic ulcers which are hard to heal, the special enzymes called matrix metalloproteins (MMPS) responsible for breakdown of malformed and damaged collagen at wound site are kept busy and the healthy collagen that is foreign to the body is thus protected, which in turn helps in the healing process.⁶ Collagen act as biological dressing, adhere to the ulcer surface, reduces the ulcer colony counts, limit fluid and protein loss, reduce pain and increases the rate of granulation and epithelialization.^{5,7,8}

METHODS

A prospective nonrandomized study was done on 100 patients of different age and sex at NIMS Medical College, Shobha Nagar, Jaipur between January 2013 to June 2016 admitted in department of general surgery and orthopedics. Informed consent was taken from all patients included in the study, HOD department of orthopedics and an ethical approval was also taken from the institute ethical committee.

Inclusion criteria

Patients with chronic ulcers in all age group and sex, diabetic ulcer, traumatic ulcer, insect bite ulcer, venous ulcer and bed sores were included.

Excluded criteria

Patients with malignant ulcer, tuberculosis, leprosy, patients with HIV and HBsAg positive were excluded.

A thorough history was taken regarding age, sex, occupation, etiology of ulcer, associated medical problem like anaemia, malnutrition, tuberculosis, diabetes mellitus, hypertension, cardiovascular disease etc., along with routine blood profile and X-ray chest and other specific investigations where needed. All wounds were thoroughly debrided under anaesthesia, washed thoroughly with H₂O₂ and normal saline and nano collagen particles sprinkled on the ulcer with utmost care to cover the whole of the ulcer floor and below the undermined edges if present. Ulcer covered with dry gauge pieces and dressed.

Table 1: List of not exhaustive currently available collagen preparation for wound care.

Trade name	Ingredients	Manufacturer
Collofiber MM	Collagen nano particle and mupirocin and metronidazole	TNC health care
Nanocoll	Collagen and silver nano oint	TNC health care
Collofiber	Bovine nano collagen powder	TNC health care
Gencoll	Collagen and gentamycin gel	TNC health care
Collograft B	Sterile bovine collagen pad	TNC health care
Colloskin	Sterile wet bovine collagen sheet	TNC health care
Colloskin M	Sterile wet bovine collagen in meshed form	TNC health care
Puracol	Collagen	Medline industries
Fibracol	Collagen	Systagenix
Biostep	Porcine collagen and CMC and Ag	Smith and nephew
Medifil	Bovine collagen gel	Biocare
Decutastar	Equine collagen	ADL
Alloderm	Human cadaver de-epithelialized skin	Lifecell corporation
Mediskin	Porcine dermis	Brennan medical
Cymetra	Particulate alloderm	Lifecell corporation

These dressings were changed on 4th, 8th, 12th, 16th day and findings noted. All patients were received the same supportive treatment in the form of antibiotics, analgesic, protein, B-complex, etc. Diabetic patients received either insulin injection or oral hypoglycemic according to blood sugar level.

Observations on subjective complaints like pain, discomfort, discharge, fever, medicine record etc. and culture and sensitivity of discharge from ulcer were made. On change of every dressing observations such as appearance of healthy granulation tissue, presence of slough, change in size of wound, neo-epithelium at

margins and presence of soakage, bleeding and pain on removal of dressing were noted.

Initial size of ulcer prior to treatment was recorded in two dimensions i.e. longitudinal and transverse, which was repeated on every change of dressing.² Ulcer healing was assessed by measuring reduction in size, epithelialization at margins, appearance of granulation tissue at floor.^{6,9,10} Study by Quillien and Goel et al favour similar results.^{11,12} Appearance of red granulation tissue and clearance of slough were taken as a sign of healing and time was recorded for comparison.

RESULTS

Out of 100 patients, male patients were more than twice of female i.e., 2.3:1 and mostly found in their most productive period of life means 3rd and 4th decade. Trauma was the most common cause of chronic ulcer (Table 2 and 3).

Table 2: Various ulcers as per etiology.

Etiology	No. of patients
Diabetic ulcer	31
Traumatic ulcer	54
Insect bite	11
Venous ulcer	7
Bed sores	2
Total	100

Table 3: Age and sex distribution.

Age (yrs)	Male	Female	Total (%)
0-20	7	4	11
21-40	28	11	39
41-60	24	9	33
>60	11	6	17
Total	70	30	

Most common cause of restricted mobility was pain (58%). TLC >11000/mm³ in 16%, BS >120 mg% in 31%, Hb <10 gm% in 27% and >20 mm in 1st hr in 32% of patients (Table 4 and 5).

Table 4: Symptoms before, during and complication after treatment.

Symptoms	No. of patients
Offensive discharge	47
Fever	21
Pain	58
Bleeding	04
Itching and burning	73
Hypertrophied scar	5
Keloid	0
Deformity	2

Table 5: Investigations.

Parameter with normal value	No. of patients	Abnormal value	No. of patients
TLC (4000-11000/mm ³)	84	>11000/mm ³	16
BS (R) 80-120 mg%	69	>120 mg%	31
Hb (>10 gm%)	73	<10 gm%	27
ESR (2-20 mm 1 st hr)	68	>20 mm 1 st hr	32

On culture from ulcer discharge most common organism detected was *staphylococcus* followed by *Klebsiella* (Table 6).

In 57% of patients total hospital stay was 11-20 days. 73% of patients require debridement only once and 73% patients complain of itching and pain after collagen application (Table 7).

Table 6: Culture of discharge.

Bacteria	No. of patients
<i>Streptococcus</i>	8
<i>Staphylococcus</i>	26
<i>Klebsiella</i>	21
<i>Proteus</i>	11
<i>E. coli</i>	7
<i>Pseudomonas</i>	12
Sterile	13
Mixed type	2
Total	100

Table 7: Stay at hospital and debridement required.

Days range	No. of patients	No. of debridement's	No. of patients
0-10	8	1	73
11-20	57	2	23
21-30	23	>2	4
>30	12	-	-



Figure 1: Ulcer on admission (etiology-insect bite).



Figure 2: Ulcer after debridement.



Figure 3: Ulcer on 8th day.

DISCUSSION

Hundred patients were included in this study having chronic ulcer situated on various parts of the body and in 53% of patients found on lower limb foot region. In 54% patients, main etiological factor was RTA, domestic accidents of violence followed by diabetic ulcer in 31%. Most of the patients suffered in their 3rd and 4th decade of most productive life. Pain (58%) and discharge from ulcer (47%) was most common cause of restricted mobility. ESR >20 mm in 1st hr in 32%, RBS >120 mg% in 31%, Hb <10 gm% in 27% and TLC >11000/mm³ found in patients under study. Anaemia, diabetes mellitus, old age, debility, bed ridden situations, bacterial contamination, ulcer in the vicinity of joint and other medical conditions were found major cause of delay in the process of healing. Average hospital stay was 16.33 days and 73% of patients required debridement only once.⁶ After debridement nano collagen particles application adhere to ulcer floor, reduces plasma oozing, bacterial colonization and pain, thus boost the process of epithelialization and early ulcer healing.^{2,5,7,9,10,13,14} Most common pathogen isolated from ulcer discharge was

staphylococcus aureus followed by *Klebsiella*, *Pseudomonas*, *Proteus*, *Streptococcus* and *E. coli* in decreasing order, in 13% culture found sterile. 73% patients complained of itching and burning sensation at ulcer site after collagen application. None of the patient showed any major side effect like anaphylaxis or immunological reaction.

CONCLUSION

In this study a total of 100 patients of different age and sex having chronic ulcer of different etiology situated on various parts of the body were included. Male to female ratio was 2.3:1. Trauma was main etiological factor. Most of the patients suffer in their most productive period of life i.e., 3rd and 4th decade. Pain in the ulcer causing restricted mobility was the most common presenting symptom. Every patient under study followed a set protocol of investigations i.e., CBC, ESR, BS and culture and sensitivity of discharge was of great help in diabetic patients and in antibiotic selection. Most common organism grown on culture was *staphylococcus*. 73% of patients require debridement only once. It was also concluded that collagen nano particles reduce plasma oozing, bacterial colonization, pain and ulcer size which boost the process of granulation, epithelialization. The cost effectiveness, ease of application and availability makes collagen a better alternative for chronic ulcer healing management, thus preventing the patient from surgical trauma of skin grafting.

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