IJPSR (2014), Vol. 5, Issue 8 (Research Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 10 February, 2014; received in revised form, 03 April, 2014; accepted, 15 June, 2014; published 01 August, 2014

CLINICAL STUDY ON INGUDI (*BALANITES AEGYPTIACA* LINN. DELILE.) WITH SPECIAL REFERENCE TO ITS ROLE IN WOUND HEALING

Sanjeev Kumar [1], Deepika Singh [2] and Kamal Nayan Dwivedi [1]

Department of Dravyaguna [1], Department of Kayachikitsa [2], I.M.S, B.H.U, Varanasi – 221005, Uttar Pradesh, India

Keywords:

Ayurveda, Vrana, Krimighna, Abhigyana-Shakuntalam, Ingudi

Correspondence to Author:

Dr. Sanjeev Kumar (MD_{AY})

Department of Dravyaguna, I.M.S, B.H.U, Varanasi – 221005, Uttar Pradesh, India

E-mail: drsanju38@gmail.com

ABSTRACT: Man, the superior most of all species has always been remaining in a search of One Prime Goal: "The perfect health". From Vedic era to space age, all the researches have been directed by the eminent scholars to achieve the same. Vrana (wound) is one of the critical conditions which have been managed by human being from starting of civilization. The present work is a substantial step for wound healing. Ingudi {*Balanites aegyptiaca* (Linn.) Delile} is well known plant used for wound healing with their specific property like laghu, snigdha guna, tikta, katu Rasa, katu Vipaka, ushna Virya and krimighna Prabhava since ancient era. Not only in Ayurvedic literature, in Sanskrit literature also have we found its description for wound healing (Abhigyan shakuntalum 4/14).

INTRODUCTION: Ancient Acharyas and their counterparts in this era tried and are still trying their best to keep the man young and virile. Veda's the source of divine knowledge, which has been enlightening the path of complete solace since ages. Vrana (wound) in Ayurveda has stated as "vrana gatra vichurnane" i.e. of tissue destruction and discolouration of viable tissue due to various etiology. Vrana is seen as debilitating and scaring disorder usually seen affecting the human being at any age. Vrana is the most important and widely described chapter of Shalya Tantra. Sushruta – The father of surgery has scientifically classified it in a systemic manner whose wealth of clinical material and the principles of management are applicable even today.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.5(8).3393-00

Article can be accessed online on: www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.5(8).3393-00

Classification of traumatic wounds, Suddha Vrana, Nadi Vrana, Sadhya Vrana, Dagdha Vrana etc., their prognostic evaluation and management in the form of sixty upakrama which are from Apatarpana to Rakshavidhana[2], insistence on primary suturing in clean wounds, avoidance of sepsis and excision of extruded omentum and careful suturing of intestinal perforation in the management of perforating abdominal wounds, etc. are remarkable as it is done in modern medicine these days [3]. Clinically wounds are classified as Acute and Chronic wounds, depending on the manner and time frame of their healing. Proper healing of wounds is essential for the restoration of disrupted anatomical continuity and disturbed functional status of the skin (Brunicardi *et al*., 2010). Wound healing is an evolutionarily conserved, complex, well-orchestrated, multicellular process that, in skin, aims at barrier restoration. This process involves the coordinated efforts of several cell types including platelets, keratinocytes, macrophages, endothelial cells and fibroblasts.

The very fact that the subject of wound healing is under study from the days of SuÐruta denotes its magnitude. During the early part of this century, research on wound healing was largely concerned with qualitative description of histological preparations and changes in the macroscopic appearance of wound during its progression towords final scar. No wonder, many researchers, all over the world are trying to evolve remedies which are effective in wound healing, but something is concrete still awaited. Ingudi *Balanites aegyptiaca* (Linn) Delile. (Hindi- Hingen, Hingan, Hingol, Hingot) [4] belonging to family Simaroubaceae. Kalidasa mentioned the presence of number of trees of 'Ingudi' where saints exist and also explained its uses in his treatise Raghuvansha (14.81).Hollow fruit of 'Ingudi' was used as container for collyrium- Kadambari (643). Seeds of 'Ingudi' were taken out on breaking the fruits by stones. People living in forest areas used 'Ingudi' taila as hair oil and for external application in wounds- Abhigyana Shakuntalam (4.14 and 1.14).

MATERIALS AND METHODS: The present study has been planned to evaluate the "Ingudi Taila"for its possible wound healing effect on vrana (wound) exclusively on clinical parameters. Drug was collected from rural area of district Itawah, U.P and identified by the teacher of Dravya Guna department in faculty of Ayurveda B.H.U. Ingudi beeja taila was prepared in tila taila in Ayurvedic pharmacy of BHU according to authentic taila paka vidhi (Reference No DG/2013-14/351, date 18-11-13) (Form No. 429).

RESULTS AND DISCUSSION: Total of 40 patients of wound more than 6 weeks attending the Dravyaguna OPD, Shalya OPD and General Surgery OPD of Sir Sundar lal, Hospital BHU, Varanasi constituted the subject material for this study. Forty patients were registered for the study and 38 patients completed the study among 40. Two were lost to follow up. So they were excluded from the study. The observation includes:

1. Observation pertaining to various investigations carried out.

2. Effect of topical application of "Ingudi" seed oil for wound healing.

The age distribution of total cases, in the study is shown in table 1. The age range was 15 to 63 years with the mean age of 35.10 (SD = ±14.60) .Majority of the patients in this study were males 34 (85%) and female 6 (15%). Most were from Bihar and Eastern part of Uttar Pradesh.

TABLE 1: DISTRIBUTION OF PATIENTS ACCORDING AGE

Age group (years)	Number of patients	Percentage
15-24	10	25
20- 34	13	32.5
33 – 44	04	10
45 – 54	08	20
55 – 64	05	12.5
Total	**40**	**100**

Mean – 35.10 ± 14.60 Range : 15 to 63 years.

The patients were divided into two groups. Group I patients were treated with antiseptic topically with debridetment. Group II patients were treated with Ingudi oil locally with debridement.

TABLE 2: AGE WISE DISTRIBUTION OF PATIENTS IN DIFFERENT STUDY GROUPS

Age group (years)	Number of patients		Percentage	
	Gr 1	Gr 2	Gr 1	Gr 2
15-24	1	9	5%	45%
25-34	10	3	50%	15%
35- 44	2	2	10%	10%
45- 54	4	3	20%	15%
54- 64	3	3	15%	15%
Total	20	20	100%	100%

In the study group the majority of the patients were males, (85%) when the two groups were compared for sex wise distribution there was no significant difference. Both the groups were similar as for their sex wise distribution was concerned.

TABLE 3: SEX WISE DISTRIBUTION OF PATIENTS IN DIFFERENT STUDY GROUPS

Groups	Male		Female		Total	
	No	%	No	%	No	%
I	18	90	2	10	20	100
II	16	80	4	20	20	100
Total	**34**	**85**	**6**	**15**	**40**	**100**

In this clinical study, 36 (90%) patients were from Hindu community and 4 (10%) from Muslim community (**Table 4**).

TABLE 4: TABLE SHOWING DISTRIBUTION OF PATIENTS ACCORDING TO RELIGION

Religion	Gr I		Gr II		Total	
	No	%	No	%	No	%
Hindu	18	90	18	90	36	90
Muslim	2	10	2	10	4	10
Total	20	100	20	100	40	100

From **table 5**, it is clear that majority of patients belong to rural area 30 (75%) and only 10 (25%) patients belong to Urban area (**Table 5**).

TABLE 5: TABLE SHOWING DISTRIBUTION OF PATIENTS ACCORDING TO HABITAT

Habitat	Gr I		Gr II		Total	
	No	%	No	%	No	%
Urban	6	30	4	20	10	25
Rural	14	70	16	80	30	75
Total	20	100	20	100	40	100

All the cases were of >6 weeks of duration. In Group I & Group II maximum cases belonged to the range of 46-90 days. Rest of the cases is more or less equally distributed, except in group II. Eight patients present in the range of 91-135 days.

TABLE 6: DISTRIBUTION OF THE PATIENTS ACCORDING TO THE DURATION OF THE WOUND

Days	No. and % of Cases					
	Gr I		Gr II		Total	
	No.	%	No.	%	No.	%
0-45	2	10	0	0	2	5
46-90	9	45	9	45	18	45
91-135	2	10	8	40	10	25
136-180	5	25	1	5	6	15
>180	2	10	2	10	4	10
Total	20	100	20	100	40	100

Table 7 depicts anatomical location of the wound on various parts of the wound on various parts of the body. The lower limb was the commonest site (45.5%) for wounds. Only in two out of 40 cases (2.55%) the wounds were present over back.

TABLE 7: ANATOMICAL LOCATION OF THE WOUND ACC. TO GROUPS

Site	No. and % of Cases					
	Gr I		Gr II		Total	
	No.	%	No.	%	No.	%
Trunk	1	5	1	5	2	5
Back	1	5	0	0	1	2.5
Buttock	2	10	3	15	5	12.5
Lower extremities	10	50	8	40	18	45.5
Upper extremities	6	30	8	40	14	35
Total	20	100	20	100	40	100

Unit healing time (Days/sq.cm.): UHT was observed and found that it is high in the age group 45-54 yrs 1.80 days/sq.cm and 0.88 days/sq.cm respectively for Group I and Group II. Minimum UHT was found in age group 15-24 yrs .156 days/sq.cm and .28 days/sq.cm respectively for Group I and Group II (Table8).

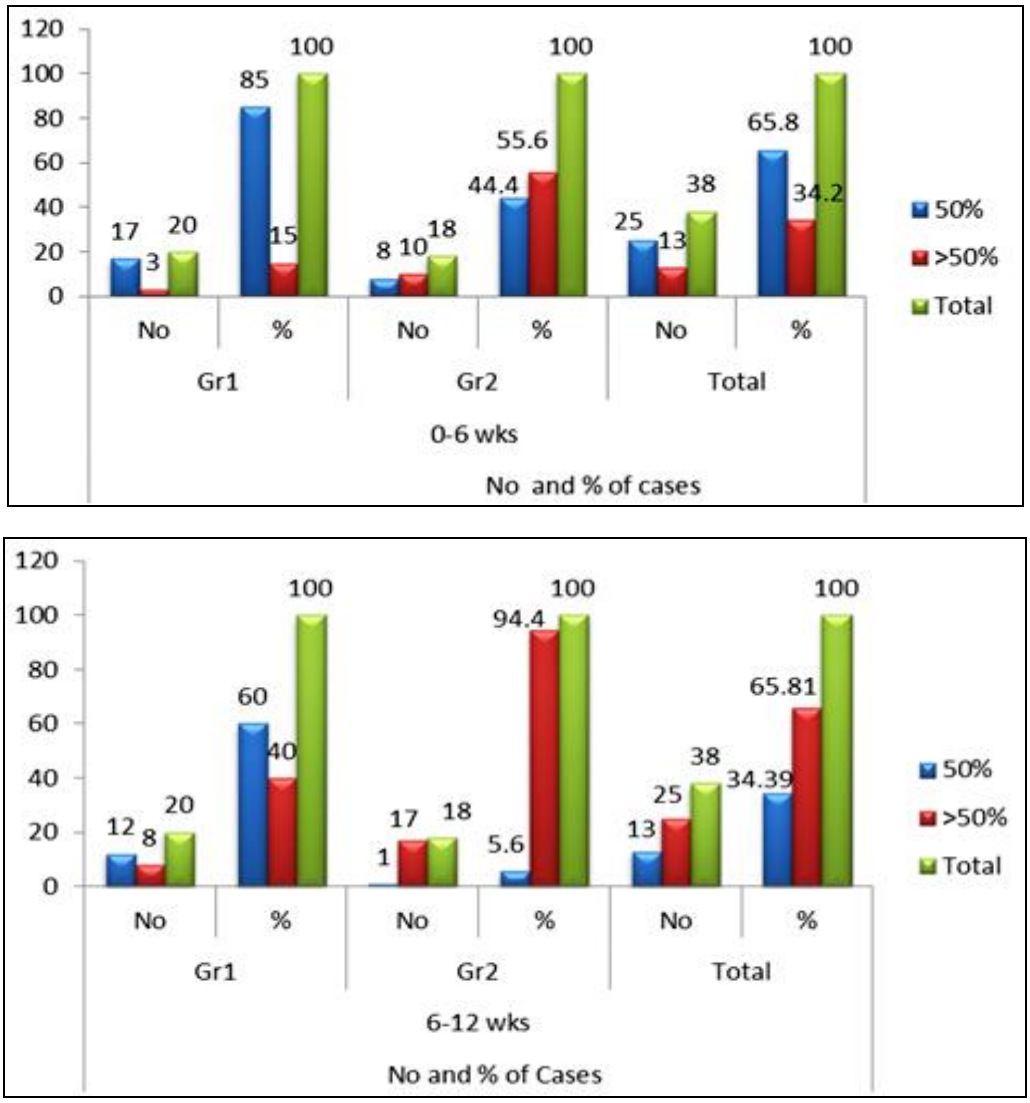
TABLE 8: SHOWING mean+SD (MEDIAN) OF UNIT HEALING TIME ACCORDING TO AGE

Age Groups	UHT in Group1	UHT in Group II
15-24 years	0.156 ± 0.00 (0.155)	1.52 ± 2.63 (0.286)
25-34years	1.03 ± 1.70 (0.25)	1.36 ± 0.00 (0.25)
35-44years	0.22 ± .11 (0.22)	0.66 ±0.12 (0.66)
45-54years	14.28 ± 24.73 (1.86)	4.43 ± 6.55 (.89)
55-64years	0.63 ±0.04 (0.63)	4.00 ± 6.82 (0.08)

Wound area reduced > 50% at 6 weeks in comparison to initial, in 3 patients in Group1 and 10 patients in Groupp2 whereas the reduction at 12 weeks was more than 50% in 8 cases of Groupp1 and 17 patients of Group 2.

TABLE 9: 50% REDUCTION IN AREA AFTER TREATMENT

50% Reduction in wound area	No. and % of cases											
	0-6 weeks						6-12 weeks					
	Gr1		Gr2		Total		Gr1		Gr2		Total	
	No.	%	No	%	No	%	No	%	No	%	No	%
50%	17	85	8	44.4	25	65.8	12	60	1	5.6	13.	34.39
>50%	3	15	10	55.6	13	34.2	8	40	17	94.4	25	65.81
Total	20	100	18	100	38	100	20	100	18	100	38	100



GRAPH 1: SHOWING 50% REDUCTION IN AREA AFTER TREATMENT

Above data shows that mean wound area initially in Group I was 34.43 and it was 23.94 in Group II. Mean wound area decreased at 6^{th} and 12^{th} weeks in both the Groups. Mean decrease from initial to 6^{th} weeks as well as 6^{th} weeks to 12^{th} weeks were found statistically highly significant in both the groups. The inter group comparison showed not statistically significant difference at initial and 6^{th} weeks however, it was statistically highly significant at 12^{th} weeks ($p< 0.01$).

TABLE 10: SIGNIFICANCE COMPARISON OF MEAN WOUND AREA OF TWO GROUPS

Groups	Area (cm^2) of wound mean ± SD and (median)			Within the Groups comparison Wilcoxon signed Rank Test	
	Initial	at 6 wks	at 12 wks	Initial-6 wks	6 wks- 12 wks
Gr I	34.43 ± 33.63 (17.50)	28.01 ± 29.64 (12.75)	24.50 ± 29.17 (9.60)	Z = 3.30 p < 0.01 HS	Z = 2.93 p < 0.01 HS
Gr II	23.94 ± 32.99 (8.50)	12.50 ± 15.75 (5.85)	1.52 ± 4.91 (0.00)	Z = 3.38 p < 0.01 HS	Z = 3.72 p < 0.001 HS
Between the group comparison	Z= 1.62 P > 0.05	Z= 1.73 p > 0.05	Z = 4.54 p < 0.01		
Mann –Whitney test	NS	NS	HS		

Antimicrobial result shown in above **table 11 & 12** revealed the presence of antimicrobial activity of the extract at concentrations 100 mg/ml and 200mg/ml. Significant zone of inhibition was observed at different concentration against *S.aureus* and *P.aeruginosa* i.e. 12.43 ± 0.84 and 11.34 ± 0.47 with minimum inhibitory concentration of 12.5 and 25 mg/ml[5,6].

TABLE 11: ANTIMICROBIAL ACTIVITY OF PLANT EXTRACT

Microorganism	Zone of inhibition (in mm)		Standard drugs
	Extract concentration (mg/ml)		
	100	200	
E. coli ATCC 25922	-	-	20 (Ciprofloxacin)
Enterococcus faecalis	-	-	22 (Ciprofloxacin)
P. aeruginosa ATCC 27893	9.60 ± 0.47	11.34 ± 0.47	20 (Ciprofloxacin)
S. aureus ATCC 25323	10.50 ± 1.63	12.43 ± 0.84	22 (Norfloxacin)
Candida albicans	-	-	18(Amphotericin B)
Candida tropicalis	-	-	18(Amphotericin B)

TABLE 12: DETERMINATION OF MIC (mg/ml)

S. No.	Bacterial Strains	MIC
1	*P. aeruginosa* ATCC 27893	25
2	*S. aureus* ATCC 25323	12.5

Probable mode of action of the drug: On the basis of above clinical (subjective and objective) findings probable mode of action of trial drug on vraÆa can be hypothetically postulated. In earlier phase the drug helps to expel out the slough and necrotic tissue due to property of Tikta rasa (kleda-medo-vasa-puya-upshosana). Further drug has reduced excessive exudation by decreasing inflammation due to Katu rasa (shvayathu-uphanti). Katu and Tikta rasa reduced bacterial load by its krimighna property (krimina-hinasti). Katu rasa also dissolve the haemorrhagic clots (shodita-sanghata-bhinatti). Katu rasa makes the level of scar at level of skin (vrananavsadayati). Katu rasa removes the infected tissue by lekhana karma (mansa-vilakhati).

Tikta rasa provide pavement for granulation tissue (tvagamansayoha-sthirikarano), and it liquefies the slough, pus and unwanted slimy materials (chedana). Tikta rasa clears the microvessels and inhances blood circulation (margana-vivranoti) around the wound area [7].

This facilitates wound healing keeping in view all characters of drug as mentioned above, the probable action of drug seems to be helpful in debriding and healing of wound which may be due to making the wound clean and free from toxin and also due to increasing microcirculation in wound area.

Therefore, it facilitates wound healing by regeneration and organization of healthy granulation and epitheliazation.

CONCLUSION: There are so many compound drugs given in our texts which are needed to be evaluated and established with scientific manner. The present work is a substantial step for wound healing as it has not been explored yet for its possible role in wound healing.

- As it is truly said by Kalidasa, Shakuntala used 'Ingudi taila' for external application in wounds (Abhigyana Shakuntalam/4.14 and 1.14). Similar description is in Sushruta about Ingudi oil regarding its use in complicated wounds.

- The inter group comparison showed no statistically significant difference at initial and 6^{th} weeks however, it was statistically highly significant at 12^{th} week ($p< 0.01$) (Table 10).

- In the subject treated with Ingudi oil the wound area reduced > 50% at 6 weeks in comparison to initial, in 3 patients in Group 1 and 10 patients in Group 2 whereas the reduction at 12 weeks was more than 50% in 8 cases of Group1 and 17 patients of Group 2 (**figure 1-6**).

- Clinical study showed that, there was highly significant reduction in Wound area. This is probably due to properties of trial drug having Katu rasa which reduces exudate and significant improvement in blood circulation of wound site by splitting of haemorrhagic clots. Tikta rasa which decreases inflammation and remove the toxins.

- Antimicrobial activity finding revealed significant role of hydroalcoholic seed extract of Ingudi against human pathogens. Antimicrobial result showed that extract significantly inhibits the growth of Gram positive bacteria *Staphylococcus aureus ATCC* 25323 and Gram negative *Pseudomonas aeruginosa* ATCC 27893. This study supports that crude extracts of Ingudi oil may be used for treatment of infected wounds.

On the basis of these findings it can be concluded that Ingudi oil is a good wound healer. It was already said that non-healing and chronic wound are mostly concerned with infections, as maximum patients involved during management of wound. So by all above references it has been scientifically proved that IÉgudÍ oil which is being used for ancient time is a potent healing promoting drug.

(Fig. 1)

Traumatic Wound
Duration of wound – 2 months
Site – Toe of Left Foot

Traumatic Wound
After 2nd Weeks
Site – Toe of Left Foot

Traumatic Wound
After 4th Weeks
Site – Toe of Left Foot

(Fig. 2)

Traumatic Wound
Duration of wound – 6 months
Site – Toe of Left Foot

Traumatic Wound
After 2nd Weeks
Site – Toe of Left Foot

Traumatic Wound
After 4th Weeks
Site – Toe of Left Foot

Fig. 3

Bed Sore–Duration of wound– 2 months
Site - Sacral region

Bed Sore
After 2 Weeks
Site - Sacral region

Bed Sore
After 4 Weeks
Site - Sacral region

Bed Sore
After 2 month
Site - Sacral region

(Fig. 4)

Traumatic Wound–Duration of wound– 2 months
Site - Plantar aspect of foot

Traumatic Wound
After 2 Weeks
Site - Plantar aspect of foot

Traumatic Wound
Ater 4 Weeks
Site - Plantar aspect of foot

Traumatic Wound
After 2 month
Site - Plantar aspect of foot

(Fig. 5)

Traumatic Wound
Duration of wound – 8 years
Leg Site – Left Anterior aspect of Leg

Traumatic Wound
After 1 month
Leg Site – Left Anterior aspect of Leg

Traumatic Wound
After 2 month
Leg Site – Left Anterior aspect of Leg

(Fig. 6)

Traumatic Wound
Duration of wound – 1.5 months
Site – Right Anterior of Forearm

Traumatic Wound
After 15 days
Site – Right Anterior of Forearm

Traumatic Wound
After 1 month
Site – Right Anterior of Forearm

REFERENCES:

1. Abhigyana shakuntalam 1 & 4 Anka.
2. Sushruta Samhita (S.Ci.1/8)
3. Sushruta Samhita (S.Ci.3)
4. Kirtikara.K.R., Basu.B.D, Indian medicinal plants, Vol.E. Blatter and J.F. Caius editor. 2nd ed. Dehradun: International book distributors; 1999. P. NO. 502, 512-514.
5. Gangwar M, Kumar D, Tilak R, Singh TD, Singh SK, Goel RK, Nath G. Qualitative phytochemical characterization and antibacterial evaluation of Glandular hairs of *Mallotus philippinensis* fruit extract. Journal of Pharmacy Research 2011; 4: 4214-4216.
6. Gautam MK, Gangwar M, Nath G, Rao CV, Goel RK (2012). *In-vitro* antibacterial activity on Human pathogens and total phenolic, flavonoid contents of *Murraya paniculata* (L.) leaves extract. Asian Pacific Journal of Tropical Biomedicine 2012; 2(3): S1660-S1663.http://dx.doi.org/10.1016/S2221-1691(12)60472-9.
7. Sushruta Samhita (S. Su 42/15-16).

How to cite this article:
Kumar S, Singh D and Dwivedi KN: Clinical study on Ingudi (*Balanites aegyptiaca* Linn. Delile.) with special reference to its role in wound healing. Int J Pharm Sci Res 2014; 5(8): 3393-00.doi: 10.13040/IJPSR.0975-8232.5(8).3393-00