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Comparing the Efficacy of Triamcinolone Acetonide Versus Bleomycin in Hypertrophic Scars in Burn Patients: A Clinical Trial

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Abstract

Background: Treatment of hypertrophic burn scars is challenging. Intralesional injection of corticosteroids has been the first line of treatment. Triamcinolone Acetonide (TA) and Bleomycin (BLE) are standard therapeutic options. We conducted a comparative study to measure the effects of BLE and TA on hypertrophic burn scars.

Methods: In this clinical trial, we enrolled 25 patients with hypertrophic burn scars in this study. In each patient, two adjacent affected areas on the body were randomly selected for intralesional injection of TA and BLE. The size of the burn scars was between 10 and 40 cm2 (square centimeter). The injections were repeated at intervals of four weeks for three periods. Follow-up of patients continued until the end of the fourth month of treatment. We used the Vancouver Scar Scale and Patient and Observer Scar Assessment Scale system to compare the recovery of each lesion. Means, standard deviation, and p-values comparing the treatment of lesions with BLE and TA using two different scales were reported. Independent samples t-test and paired sample t-test were used to find out a statistically significant difference between BLE and TA treated lesions.

Results: The results showed that the hypertrophic scar scores in BLE and TA lesions were statistically significant from the perspective of patients and physicians ($P = 0.035$). The mean score of hypertrophic scars in the BLE and TA groups was also statistically significant ($P = 0.023$). The proportion of individuals who had no side effects after taking BLE and TA was much higher than those who experienced skin pain or hypopigmentation.

Conclusion: Intralesional BLE injection is more effective than TA in treating hypertrophic scars. Further studies with larger sample sizes are needed to approve these results.

Keywords: Intralesional, Bleomycin, Triamcinolone Acetonide, Hypertrophic scar

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Introduction

Colloids and hypertrophied scars are two types of abnormal scars on the skin (1-4), characterized by a tendency to recur (5). Skin damage leads to hypertrophic scars and colloids by overproduction of Collagen and glycosaminoglycans (6). These lesions are considered benign; however, they are causing pain and cosmetic problems for the patients (7). Various treatments are available for colloids and hypertrophied scars, such as occlusive dressings, intralesional corticosteroids, laser therapy, intralesional Bleomycin (BLE), surgery, etc. (1-6).

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↑What is "already known" in this topic:
Triamcinolone acetonide is the most commonly used intralesional steroid for the treatment of keloids and hypertrophic scars. Belomycin is also used for the treatment of keloids and hypertrophic scars, but it is not as commonly used as triamcinolone acetonide.

→What this article adds:
Intralesional Bleomycin injection is more effective than Triamcinolone acetonide in treating hypertrophic scars. However, due to its side effects such as allergic reactions, darkening and thickening of the skin, it is not widely used in practice.

BLE is a water-soluble glycopeptide antibiotic derived from the fungus Streptom

yces Verticularis and has anti-cancer, anti-fungal, and anti-viral effects. As a chemotherapy agent, BLE is widely used to treat various types of cancer (4, 6, 7).

BLE has been reported in various reports as an effective treatment for colloids and hypertrophic scars using multiple methods such as Dermojet, Multiple needle punctures, and tattoos or syringe injections (4-14). The mechanism of action of BLE is apoptosis and necrosis of keratinocytes associated with sclerosis of endothelial cells. In addition, BLE causes the inhibition of the enzyme lysyl oxidase and TGF-Beta increases fibroblast apoptosis and prevents Collagen from being synthesized in skin fibroblasts (7-10).

TA is the most commonly used corticosteroid in treating keloids (11). The dosage, duration, and success rate of treatment of keloids with TA are variable in different studies. Corticosteroids cause keloid regression through different mechanisms. These agents suppress inflammation by inhibiting leukocyte and monocyte migration and phagocytosis. They can also decrease the delivery of oxygen and nutrients to the tissue by vasoconstriction. (3, 5, 11).

Considering the effects of BLE and TA in previous studies (4-8, 9-14) and the lower side effects of BLE in comparison to TA (14), we decided to conduct comparative research to evaluate the impacts of BLE and TA on hypertrophic burn scars to observe whether intralesional BLE is more efficacious than intralesional TA in the treatment of hypertrophic burn scars or not?

Methods

This double-blinded clinical trial study enrolled patients with hypertrophic burn scars at Shahid Motahari and Hazrat Fatemeh Hospital in Tehran from September 2017 to August 2019. Patients did not know whether they were injected with BLE or TA. Also, the provider who was injecting the medicines was not aware of which medication he was injecting. Only the principal investigator knew whether it was TA or BLE. The Iran University of Medical Sciences ethics committee approved this study, and patients or their guardians signed informed consent. This study was registered with the code number IRCTID: IRCT201202041009431N4 at the Iranian Registry of Clinical Trials

Inclusion criteria were as follows: Patients with hypertrophic scars after burn injuries, age ≥ 18 years old and ≤ 70 years old, at least two hypertrophic scars on the body with sizes at least 1 cm (0.39 inches) in diameter, at least two months after burn injury. Exclusion criteria were as follows: Age <18 years old and >70 years old, pregnant and lactating women, scars caused by electrical or chemical burns or a previously treated burn, patients diagnosed with diabetes or kidney disease, patients with underlying or malignant diseases, and current use of corticosteroids. Figure 1 shows the consort diagram of patients in this study.

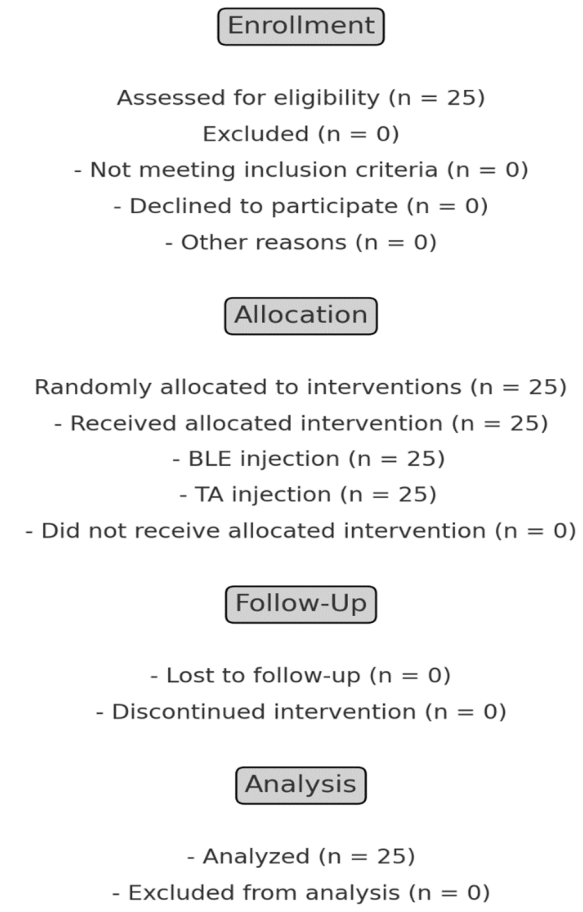

Figure 1. CONSORT Flow Diagram of Participant Progression

Therapeutic Interventions and Measurement of the Scars

We randomly selected two different lesions in each patient for intralesional injections of TA and BLE. The size of the burn areas was between 10 and 40 cm^2. The injection sites for TA and BLE were clearly identified to avoid any mistakes for future injections. The maximum dose of TA was 80 mg per period with a 10 mg/ml concentration and 0.2 ml/cm^2. The maximum amount of BLE was ten units with a concentration of 1.5 u/ml and 0.1 ml/cm^2. The injection was performed in a multi-puncture manner with a 27-gauge needle under sedation in the operation room. The injections were repeated at intervals of four weeks for three periods.

Patients were not aware of the materials in the injection syringes. Also, the provider who was injecting the medications was not aware whether it was TA or BLE. Only the principal investigator knew which syringe contained TA or BLE.

We took the images of lesions at the beginning of the study and the end of the fourth month with an 80D camera, Lenze 24-70mm): Canon (Model quality image to be compared by two plastic surgeons—each lesion using the Patient System and Observer Assessment Scale (POSAS).

Data Analysis

We used an independent samples t-test to find out if there is any statistically significant relationship between BLE and TA-treated lesions. A paired samples t-test was used to

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determine if there is any statistically significant relationship within each group (i.e., each variable in BLE-treated lesions). *P*-values less than 0.05 were considered statistically significant. The software used for data analysis was SPSS version 22 (SPSS Inc., Chicago, Ill., USA).

Results

Patients consisted of sixteen females (64%) and nine males (36%), with a mean age of 36.48 ± 17.08. Table 1 presents the characteristics and demographics of the patients. Means, standard deviation and p-values comparing treatment of lesions with BLE and TA using two different scales are reported in Tables 2 & 3.

Table 2 depicts the comparison of the hypertrophic scar score after using BLE and TA. The results were statistically significant in improving pain, itching, color, stiffness, thickness, and lesion healing rate ($P = 0.035$). The results of this study showed that the mean score of hypertrophic scars in the BLE group and TA group was statistically significant ($P < 0.05$).

Based on the results depicted in Table 2, the hypertrophic scar scores in the BLE and TA groups were statistically significant in improving vascularity, pain relief, thickness, pigmentation, surface area, and pliability ($P < 0.05$).

Discussion

The results of data analysis showed that the score of hypertrophic scar in the BLE-treated lesions was statistically significant in general and from the perspective of patients and physicians ($P < 0.05$). Thus, the hypertrophic scar due to heat burn healed after injection of BLE into lesions.

An epithelialization process lasting more than 21 days will increase the risk of developing hypertrophic scars. The amount of TGF-β, the rate of fibroblasts' response to TGF-β secretion, and the amount of IGF-1 (insulin-like growth factor-1) will increase in these lesions. In addition, there are more Langerhans cells, T lymphocytes, and mast cells in the hypertrophic scar than in normal tissues.

Our results are similar to some other studies. In a study by Khan and his colleagues, they compared the effectiveness of intralesional injection of TA and BLE; they found that BLE injection effectively improved hypertrophic scars

Table 1. Characteristics of Patients with Hypertrophic Scars Undergoing Treatment with BLE and TA Injections

Patient	Gender	Age	Etiology of Burn	Degree of Burn	Location of Scar(s)	Previous Treatment
1	F	24	Scald	2	Forearm & Hand	Surgery
2	F	38	Scald	2	Hand	Surgery
3	F	42	Contact	3	Hand	Surgery, Laser therapy
4	F	19	Scald	2	Arm, Forearm, Hand	Surgery
5	F	41	Scald	2	Hand	Laser therapy
6	F	35	Contact	2	Hand	Surgery
7	F	58	Scald	2	Chest,arm,forearm	Surgery
8	F	27	Scald	2	Head, Back, arm	Surgery, laser therapy
9	F	33	Contact	3	Forearm, Hand	Surgery
10	F	52	Contact	2	Hand	Surgery
11	F	49	Scald	2	Face, Head, arm	Surgery, TA
12	F	31	Scald	2	Arm, forearm, hand	Surgery
13	F	25	Contact	3	Hand, Forearm	Surgery, Laser therapy
14	F	56	Scald	2	Chest, arm, forearm, hand	Surgery
15	F	45	Contact	3	Hand, Forearm	Surgery
16	F	26	Contact	2	Back, arm	Surgery
17	M	32	Scald	2	Hand, forearm, arm	Surgery
18	M	21	Scald	2	Hands, forearms	Surgery
19	M	53	Scald	2	Hand, forearm, arm	Surgrey
20	M	29	Contact	2	Chest, arm, forearm, hand	Surgery
21	M	37	Contact	3	Hands, forearms	Surgery, TA
22	M	51	Scald	2	Head, chest, arms	Surgery
23	M	32	Scald	2	Hands, arms, forearms	Laser therapy
24	M	19	Contact	3	Hands, forearms	Surgery
25	M	34	Scald	2	Chest, arms	Surgery, Laser Therapy

TA: Triamcinolone Acetonide

Table 2. Comparison of Hypertrophic Scars Using Vancouver Scar Scale with BLE and TA before and after treatment

Medication	Parameters	Pre-Injection (Mean ±SD)	Post-Injection (Mean ±SD)	*P*-value*
BLE	Vascularity	2.44 ±0.51	1.64 ± 1.24	0.040
	Pigmentation	1.32 ±0.46	2.72 ±1.77	0.030
	Pliability	9.41 ±0.49	3.14 ±1.32	0.001
	Height	9.52 ±0.51	2.92 ±1.08	< 0.001
TA	Vascularity	9.36 ±0.49	3.52 ±1.61	0.001
	Pigmentation	9.42 ±0.51	5.24 ±2.28	0.020
	Pliability	9.33 ±0.48	4.08 ±1.73	0.010
	Height	9.62 ±0.54	4.52 ±1.98	0.020

• P-value was calculated using independent samples t-test method.

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Table 3. Comparison of Hypertrophic Scars Using Manchester Scar Scale (MSS) with BLE and TA before and after treatment

Medication	Parameters	Pre-Injection (Mean ±SD)	Post-Injection (Mean ±SD)	*P*-value*
BLE	Pain	9.44 ±0.51	2.04 ± 1.24	< 0.001
	Itching	9.32 ±0.46	2.72 ±1.77	< 0.001
	Skin Color	9.41 ±0.49	3.14 ±1.32	< 0.001
	Lesion Stiffness	9.52 ±0.51	2.92 ±1.08	< 0.001
	Thickness	9.48 ±0.48	3.36 ±1.52	< 0.001
	Rate of recovery	9.46 ±0.50	3.84 ±1.28	< 0.001
TA	Pain	9.36 ±0.49	3.52 ±1.61	< 0.001
	Itching	9.42 ±0.51	5.24 ±2.28	<0.001
	Skin Color	9.33 ±0.48	4.08 ±1.73	<0.001
	Lesion Stiffness	9.62 ±0.54	4.52 ±1.98	<0.001
	Thickness	9.55 ±0.49	4.84 ±2.21	<0.001
	Rate of recovery	9.71 ±0.53	4.94 ±1.98	<0.001

• The P-value was calculated using the independent samples t-test method.

(15). Another study by Fatemi Naeini and colleagues studied the effect of BLE tattoos with cryotherapy in combination with intralesional injection of TA on colloid and hypertrophic scars. They concluded that BLE tattoos significantly improved colloid and large scars in hypertrophy (16). Also, Manca and his team found that clinical responses to BLE in combination with electroporation in the treatment of colloid and hypertrophic scars were positive (4).

The results of data analysis showed that the hypertrophic scar score in the TA group and from the perspective of patients and physicians was statistically significant ($P < 0.05$). The hypertrophic scar due to heat burn had healed after intralesional injection of TA

In an RCT evaluating the effect of TA on hypertrophic burn scars, there was a significant reduction in thickness in the intervention group. There has been an increase in the elasticity of the sections involved with the scar (17). In the study by Khan et al., they found that TA injection positively improved the healing process of hypertrophic scars (15).

The results of our study showed that the mean score of hypertrophic scars in the BLE group and TA group was statistically significant ($P < 0.05$). So the rate of improvement in the group therapy with BLE was higher than the group therapy with TA.

In a study by Khan et al., based on the Patient Scar Assessment Scale and the POSAS Checklist, it was found that intradermal BLE injection was more effective than intracutaneous TA in the treatment of colloids and hypertrophic scars (15).

Pew Wei Papong and colleagues also concluded in their study that injecting 1 mg/ml BLE into the wound is a safe and effective method for the treatment of colloids and hypertrophic scars and that this treatment can be done by injecting 10 mg/ml TA into the wound. BLE can be a replacement for TA acetate, especially in lighter skin (6).

In the study by Yasemin et al., A proper therapeutic response to intralesional BLE was observed using the high-pressure injection (Dermojet) method, even in patients who failed treatment with TA (in terms of reduced scarring, itching, and pain in the affected area) (18).

In this study, we observed that the mean score of hypertrophic scar in terms of gender in the BLE group was not statistically significant ($P < 0.05$). Also, the mean score of hypertrophic scars in patients in the age groups of 24 years and less, 25-34 years, 35-44 years, 45-45 years, and 55 years and above was not statistically significant ($P < 0.05$).

In this regard, in a study by Kabel et al., Which compared intravenous injection of BLE and 5-fluorouracil in the treatment of colloids and hypertrophic wounds, it was found that no relationship between age, gender, and response to treatment processes was found (19). In Khan et al.'s study, the effect of gender was studied in different treatment groups. The results showed that gender does not affect the type of treatment, and therefore, the results of the present study are consistent with the results of these studies (15).

The results of this study showed that the proportion of people who did not have side effects after taking BLE was much higher than those who experienced pain or skin atrophy ($P < 0.05$). This result was also accurate for TA group therapy, so the proportion of people who had no side effects after taking TA was much higher than those who experienced pain or skin atrophy ($P < 0.05$).

In a clinical trial study by Reddy et al., which examined the role of BLE in the treatment of hypertrophic scars and colloids, they found no side effects (such as ulceration or atrophy) at the injection site (20). In the study of Dean Hu et al., After treatment with BLE, pain was identified as one of the side effects of this treatment (17), which is inconsistent with the present study results.

The limitation of the current study was the small number of cases and a longer time for the follow-ups to observe the possible complications of the injections. Moreover, we suggest performing a multi-center study with a larger number of cases.

Conclusion

Both treatments improved hypertrophic scars; however, Bleomycin was more effective than Triamcinolone Acetonide in treating keloid lesions. Our study findings state that Bleomycin injections can be used in treating keloid scars.

Authors' Contributions

All authors contributed to the study's conception and design. S.F., A.S., and R.V. contributed to data collection, interpretation of data, and writing of the manuscript; B.S., P.G. and Y.G. contributed to the writing of the manuscript, interpretation of data, and statistical analysis; R.V., Y.G. and S.F. contributed to analysis and the first draft of the manuscript. All authors read and approved the final manuscript.

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Ethical Considerations

This study has been approved by the Research Ethics Committee at Iran University of Medical Sciences.

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Conflict of Interests

The authors declare that they have no competing interests.

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