Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2023.250902.3015 Volume 30, Issue 1.1, - January 2024, Supplement Issue

Manuscript ID ZUMJ-2311-3015 (R1)
DOI 10.21608/ZUMJ.2023.250902.3015

Original article

Comparison between Intralesional Injection of Botulinum Toxin A and Triamcinolone in Management of Recent Hypertrophic Scars

Amr Abdallah Gomaa[1], Mohammed Abdelmoety Elbadawy[2], Moaaz Fathy Hamed Abbady[3] , Ahmed Mohamed Aboelnaga[4]

[1]Lecturer of Plastic Surgery, Faculty of Medicine, Suez Canal University, Ismailia, Egypt
[2]Professor of Plastic Surgery, Faculty of Medicine, Suez Canal University, Ismailia, Egypt
[3] Specialist of Plastic Surgery, Suez general hospital, Suez, Egypt
[4]Associate professor of plastic surgery, Faculty of Medicine, Suez Canal University, Ismailia, Egypt

Corresponding author*

Amr Abdallah Gomaa

Email:
amrpc2000@yahoo.com

Submit Date 24-11-2023
Revise Date 09-12-2023
Accept Date 2023-12-12

Abstract

Background: Hypertrophic scars lead to aesthetic and local symptoms like pain and itching. Moreover these scars have psychological effects such as emotional disturbances, embarrassment, low self-confidence, and social isolation. Many treatment modalities had been used, but each one has its limited effect.

Objectives: The aim of the study is to evaluate the role of hypertrophic scars management by comparing intralesional injection of Botulinum Toxin (BTX-A) to intralesional injection of triamcinolone .

Subjects and methods: This study was carried on 20 patients with hypertrophic scars, their scars were divided into two equal sectors, one sector was injected with BTX-A while the other sector was injected with corticosteroid (triamcinolone) as a control. Assessment of the results were achieved objectively and digitally photographed using the same camera, lightening setting and patient positioning before treatment, at one-month, three months and six months' visits. The hypertrophic scar score was calculated before and after treatment by patient and observer scar assessment scale (POSAS).

Results: There was statistically significant improvement in both BTX-A and triamcinolone injected scars. The different parameters that assessed by POSAS showed better improvement and significant lower scores in the BTX-A injected areas without side effects. The triamcinolone injected scars showed complication such as atrophy, hypopigmentations. The results of the study revealed that BTX-A has a significant role in treatment of hypertrophic scars with minimal side effects.

Conclusion: In conclusion, intralesional injection of BTX-A is suitable for treatment of recent hypertrophic scars with decreasing associated pain and itching and better tolerated than corticosteroid.

Keywords: Botulinum Toxin A, Triamcinolone, Hypertrophic Scars.

INTRODUCTION

Hypertrophic scars (HTSs) are elevated erythematous scars that do not overgrow into surrounding tissues and may regress spontaneously. HTSs and keloids are resulted from increased inflammatory response, over

deposition of fibroblasts, and abnormal accumulation of growth factor signals that create abnormal production of collagen and fibrosis in these scars. HTSs can be associated with local symptoms such as pain, itching and embarrassing appearance leading to cosmetic and functional disability.[1]

HTSs not only lead to aesthetic and local symptoms, but also have psychological effects like emotional disturbances, low self-confidence , depression and social isolation beside the functional problems.[2]

In the developed countries, it has been reported that 100 million people had scars annually, some of which cause remarkable problems, as a result of 55 million elective surgeries and 25 million operations following trauma.[3]

The goal of HTSs management is to obtain a more acceptable general appearance and control of local symptoms. Unfortunately, none of the available recent treatments modalities can completely resolve the scars. Combination of different treatment techniques may provide additional improvement compared with single technique only.[4]

Intralesional scar injection of corticosteroid has usually remained the most popular treatment for HTSs and keloids. Corticosteroids achieve scar regression through many mechanisms. They decrease inflammation by phagocytosis inhibition and suppression of monocyte and migration leukocyte.[5] Besides, they are strong vasoconstrictors, thus reduce the nutrients and oxygen delivery to the scar bed through their strong vasoconstrictor effect.[5] Corticosteroids have an anti-mitotic effect that suppresses fibroblasts and keratinocytes activities, slowing new collagen fibers formation and re-epithelialization. Moreover, they may decrease plasma protease inhibitors, allowing collagenase enzyme to degrade collagen. [6, 7]

Despite the benefits, scars corticosteroid injections may cause many local side effects such as skin thinning, subcutaneous fat atrophy, telangiectasias, pigmentation problems (hypopigmentation or hyperpigmentation), skin necrosis and ulcerations. Systemic effects may occur, such as Cushing's syndrome.[8]

Intralesional injection of Botulinum toxin type A (BTX-A) was found to be accepted, simple, well tolerated method of treatment to improve different parameters of HTSs. It can be used in combination with other modalities of treatments to achieve remarkable results. BTX-A can lead to overall improvement in the scar general appearance and local symptoms such as pruritus. It hasn't remarkable side effects. [9-11]

The BTX-A has a number of beneficial mechanisms that improve HTSs including the reduction of muscle tension [12], modification of fibroblast activity and antipruritic effect. [13-16]

In this study, we compared the intralesional injection of BTX-A versus triamcinolone in management of early hypertrophic scars in terms of general appearance, symptoms and complications.

This study aimed to compare the role of intralesional injection of BTX-A versus triamcinolone in management of recent hypertrophic scars.

PATIENTS AND METHODS

Study design:

The study was prospective randomized controlled clinical trial. It was carried on 20 patients with hypertrophic scars, their scars were divided into two equal sectors, one sector was injected with triamcinolone as a control while the other sector was injected with BTX-A. They will receive one session of injection every month for 3 months without additional topical treatment.

Study setting:

The study was carried out at the outpatient clinic of plastic surgery of Suez Canal University Hospitals. We obtained a written informed consent for intervention and treatment along with clear photography from all patients before enrollment in the study. The study was approved by ethical committee of faculty of medicine, Suez Canal University.

Inclusion criteria:

- Scars at any site
- Large scars that can be divided into two parts to allow the injection with control area.
- Scar duration less than 6 months.

Exclusion criteria:

- Pregnancy, lactation.
- Skin lesions or diseases in the injection area.
- Patients with severe systemic disease or pre-existing neuromuscular.
- Fitzpatrick skin type V, Vl.

Injection technique:

To anaesthetize the scar area, topical anesthesia cream composed of Lignocaine and Prilocaine was used with occlusion for 30- 45 minutes before injection. The injection site was prepared

using Povidone Iodine or alcohol 70%.Triamcinolone acetonide (Epirelephan) 40 mg⁄mL was injected undiluted in the first half of the scar. We did tunneling of the scar by 30 gauge needle before injection. Afterwards, the Triamicinolone was injected into the body of the HTS (intralesional) until slight blanching was clinically seen (figure 1). The dose was up to 0.2ml /cm2 of the scar, not exceeding 2 mL/session. Botulinum toxin type A was used as Botox Allergan ® 50 U which was diluted in 1mL saline. It was injected by the same technique of Triamicinolone. The dose was up to 5 U/cm2 of the scar, not exceeding 50 U in one session.

Assessment

Digital photography was done using the same camera, lightening setting and patient positioning, at first presentation before injection, three months and six months post-injection. Assessment of the results was done both subjectively and objectively. The hypertrophic scar score before and after treatment (3months and 6 months post injection) was assessed by the Patient and Observer Scar Assessment Scale (POSAS).[17] Patients were asked to assess the improvement by patient assessment scale. An independent observer rated the improvement of scars using Observer assessment scale of hypertrophic scars. Each scale has 6 parameters, which rated from 1 (best score) to 10 (worst score) for each parameter.

RESULTS

The demographic data of the participants revealed that the mean age was 30±18.8 years old and the males formed half of the patients.

On reviewing the clinical characteristics related to the hypertrophied scare lesions (Table 1), the two thirds of the skin type were categorized as type IV and about more than half of the scar's duration was 2-3 months and occurred due to traumatic events (55%). Abdomen, chest and both limbs were the most common sites of the scars. The mean scar length was 7.3 ± 2.8cm (4 - 13cm)

The baseline scar parameters of the POSAS revealed that the most affected item in the patient scale was itching 7.10 ± 1.37. The most affected observer item was the thickness 6.50 ± 1.32. (tables 2 and 3). There was improvement in all parameters after injection of both botox and triamcinolone.

Table 2 shows that the parts of scars injected with Botox had statistically significant lower patient score (11.05 ± 2.39) than scars injected with triamcinolone (14.95 ± 2.11) ($p<0.001$) after 6 months. The most improved item was itching in both Botox and triamcinolone group.

Table 3 shows that the parts of scars injected with Botox had statistically significant lower total observer score (9.75±2.51) than scars injected with triamcinolone (13.75 ± 2.57) after 6 months ($p<0.001$). The most improved item was thickness in both botox and triamcinolone group.

Table 4 showed that regarding the parts of the scars that injected with Botox, the mean total patient scores at 6 months (11.05 ± 2.39) was significantly lower than that at 3-month visit (19.80 ± 4.01) and the baseline (33.90 ± 7.46). Similarly, in the parts of the scars injected with triamcinolone, total patient score at 6 months (14.95 ±2.11) was significantly lower than that at 3-month visit (22.90 ± 3.71) and the baseline (34.05 ± 7.72). Moreover the all parameters in both groups showed significant improvement.

Table 5 showed that regarding scars areas that injected with botox, it was found that mean total observer scores at 6 months (9.75 ± 2.51) was significantly lower than that at 3-month visit (17.25 ± 4.06) and the baseline (28.25 ± 6.41). Similarly, in scars areas that injected with triamcinolone, the mean total observer scores at 6 months (13.75±2.57) was significantly lower than that at 3-month visit (20.80 ± 4.40) and the baseline (29.25 ± 5.41). Moreover the all parameters in both groups showed significant improvement.

The Botox injection areas showed no complications. On the other hand, the Triamcinolone injection areas showed scar atrophy and depression 4 (20%), hyopigmentations 6 (30%)

The following are three cases were injected by Botox and Triamcinolone after three and six months (figures 2, 3, and 4)

Table 1: Clinical characteristics related to the hypertrophied scar lesions

Variables	N= 20
Skin type, n (%)	
III	8 (40%)
IV	12 (60%)
Scar duration, n (%)	
< 1 month	5 (25%)
1-2 month	4 (20%)
2-3 month	11 (55%)
Scar etiology, n (%)	
Post-operative	4 (20%)
Post-burn	5 (25%)
Traumatic	11 (55%)
Scar site, n (%)	
Face & neck	2 (10%)
Abdomen & chest	6 (30%)
Back	2 (10%)
Upper limb	5 (25%)
Lower limb	5 (25%)
Scar length, n (%)	
< 5 cm	10 (50%)
≥ 5 cm	10 (50%)

Table 2: Comparison between triamcinolone and botulinum group in regard to patient scale assessment items at the 6-month visit

Variables	Baseline (n=20) mean ± SD Baseline (n=20)	Botulinum (n=20) mean ± SD	Triamcinolone (n=20) mean ± SD	p-value
Pain	2.90 ± 2.79	1.25 ± 0.55	1.25 ± 0.44	0.9 [a]
Itching	7.10 ± 1.37	1.25 ± 0.44	1.75 ± 0.64	0.008 [a]
Color difference	5.55 ± 1.57	2 ± 0.79	2.95 ± 0.6	<0.001 [a]
Stiffness	5.25 ± 1.74	1.85 ± 0.67	2.65 ± 0.67	<0.001 [a]
Thickness difference	6.65 ± 1.46	2.05 ± 0.69	2.75 ± 0.72	<0.001 [a]
Irregularity	6.60 ± 1.27	2.65 ± 0.93	3.6 ± 0.82	<0.001 [a]
Total patient score	33.90 ± 7.46	11.05 ± 2.39	14.95 ± 2.11	<0.001 [a]

[a]there was a statistical significant difference (p-value < 0.05)

Table 3: Comparison between triamcinolone and botulinum group in regard to observer scale assessment items at the 6-month visit

Variables	Baseline (n=20) mean ± SD	Botulinum (n=20) mean ± SD	Triamcinolone (n=20) mean ± SD	p-value
Vascularity	5.55 ± 2.42	1.85 ± 0.88	2.50 ± 1.05	<0.001 [a]
Pigmentation	4.95 ± 1.5	2.10 ± 1.07	2.80 ± 0.95	0.001 [a]
Pliability	5.50 ± 1.73	1.9 ± 0.55	2.75 ± 0.79	<0.001 [a]
Thickness	6.50 ± 1.32	1.8 ± 0.41	2.70 ± 0.57	<0.001 [a]
Relief	5.85 ± 1.6	2.1 ± 0.85	3 ± 0.86	<0.001 [a]
Total observer score	28.25 ± 6.41	9.75 ± 2.51	13.75 ± 2.57	<0.001 [a]

[a]there was a statistical significant difference (p-value < 0.05)

Table 4: Patient scale assessment in both groups among different time points

Variables	Baseline (n=20) mean ± SD	3-month (n=20) mean ± SD	6-month (n=20) mean ± SD	p-value
Botulinum group				
Pain	2.90 ± 2.79	2.00 ± 1.45	1.25 ± 0.55	**0.001** [a]
Itching	7.10 ± 1.37	3.55±1	1.25 ± 0.44	**<0.001** [a]
Color difference	5.55 ± 1.57	3.45 ± 0.83	2 ± 0.79[α,]	**<0.001** [a]
Stiffness	5.25 ± 1.74	2.95 ± 0.69	1.85 ± 0.67	**<0.001** [a]
Thickness difference	6.65 ± 1.46	3.70 ± 1.17	2.05 ± 0.69	**<0.001** [a]
Irregularity	6.60 ± 1.27	4.11 ± 1.15	2.65 ± 0.93	**<0.001** [a]
Total patient score	33.90 ± 7.46	19.80 ± 4.01	11.05 ± 2.39	**<0.001** [a]
Triamcinolone group				
Pain	2.90 ± 2.79	1.90 ± 1.29	1.25 ± 0.44	**0.001** [a]
Itching	7.10 ± 1.37	3.95 ± 0.83	1.75 ± 0.64	**<0.001** [a]
Color difference	5.55 ± 1.57	4.10 ± 0.85	2.95 ± 0.6	**<0.001** [a]
Stiffness	5.25 ± 1.74	3.70 ± 0.73	2.65 ± 0.67	**<0.001** [a]
Thickness difference	6.65 ± 1.46	4.30 ± 1.26	2.75 ± 0.72	**<0.001** [a]
Irregularity	6.60 ± 1.27	4.95 ± 1.05	3.6 ± 0.82	**<0.001** [a]
Total patient score	34.05 ± 7.72	22.90 ± 3.71	14.95 ± 2.11	**<0.001** [a]

Table 5: Observer scale assessment in both groups among different time points

Variables	Baseline (n=20) mean ± SD	3-month (n=20) mean ± SD	6-month (n=20) mean ± SD	p-value
Botulinum toxin group				
Vascularity	5.55 ± 2.42	3.40 ± 1.39	1.85 ± 0.88	**<0.001** [a]
Pigmentation	4.95 ± 1.5	3.20 ± 1.11	2.10 ± 1.07	**<0.001** [a]
Pliability	5.50 ± 1.73	3.40 ± 1.14	1.9 ± 0.55	**<0.001** [a]
Thickness	6.50 ± 1.32	3.75 ± 0.91	1.8 ± 0.41	**<0.001** [a]
Relief	5.85 ± 1.6	3.50 ± 1.19	2.1 ± 0.85	**<0.001** [a]
Total observer score	28.25 ± 6.41	17.25 ± 4.06	9.75 ± 2.51	**<0.001** [a]
Triamcinolone group				
Vascularity	5.55 ± 2.42	3.95 ± 1.61	2.50 ± 1.05	**<0.001** [a]
Pigmentation	4.95 ± 1.5	3.80 ± 1.06	2.80 ± 0.95	**<0.001** [a]
Pliability	5.50 ± 1.73	4.15 ± 1.31	2.75 ± 0.79	**<0.001** [a]
Thickness	6.50 ± 1.32	4.55 ± 1.10	2.70 ± 0.57	**<0.001** [a]
Relief	5.85 ± 1.6	4.35 ± 1.14	3 ± 0.86	**<0.001** [a]
Total observer score	28.25 ± 6.41	20.80 ± 4.40	13.75 ± 2.57	**<0.001** [a]

[a]there was a statistical significant difference (p-value < 0.05)

Figure 1: the material was injected into the body of the hypertrophic scar (intralesional) by 30 gauge needle until slight blanching was clinically seen

Figure 2: Case 1, 30 years old male patient with post-traumatic hypertrophic scar at right forearm of one-month period. a: the scar before injection, b: Three months post injection, c: six months post injection. (S: Steriod injection site, B Botox injection site.)

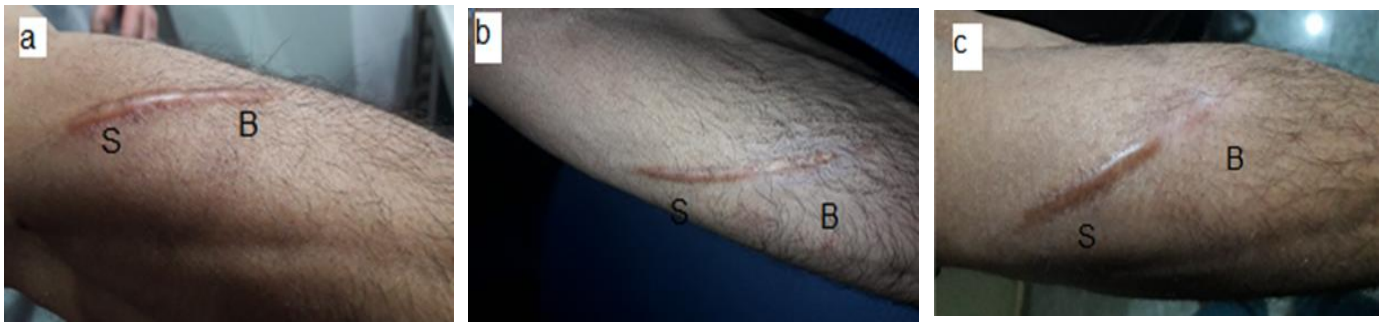


Figure 3: Case 3, fifteen years old male patient with post-traumatic hypertrophic scar at left side of face of two months period. a: the scar before injection, b: Three months post injection, c: six months post injection. The steroid injection site showed mild atrophy after 6 months (S: Steriod injection site, B Botox injection site.)

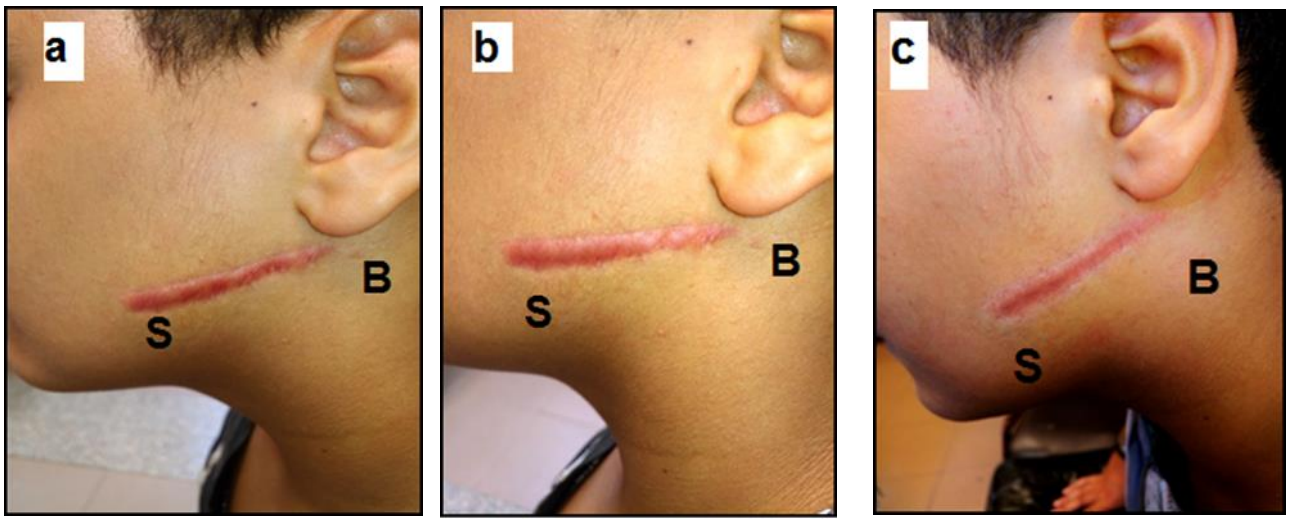
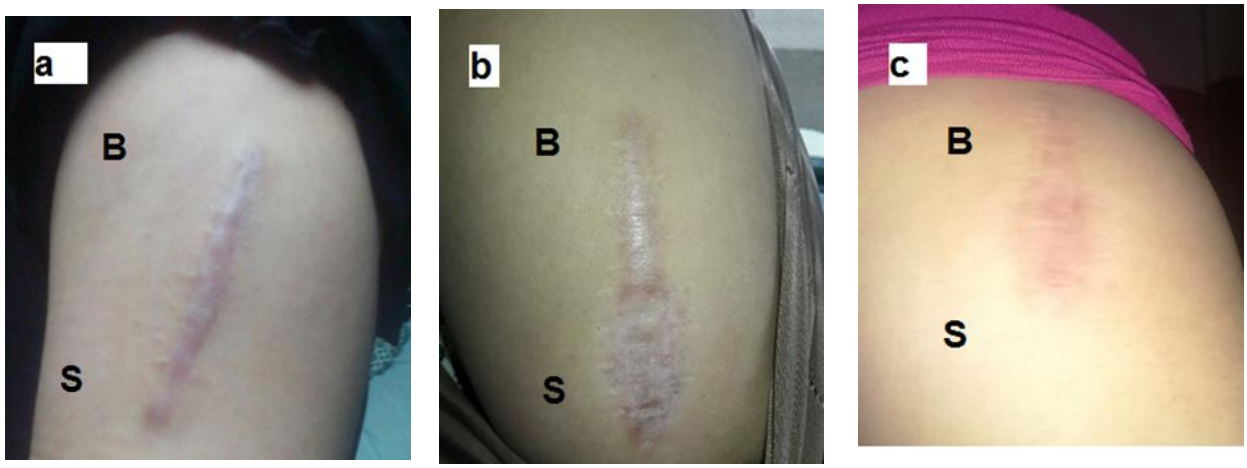


Figure 4: Case 4, 35 years old female patient with post-traumatic hypertrophic scar at left arm of six weeks period. a: the scar before injection, b: Three months post injection, c: six months post injection. The steroid injection site showed mild atrophy and telangtesia after 3 months (S: Steriod injection site, B Botox injection site.)



DISCUSSION

At this study, we used POSAS to evaluate the outcome of the study, and with regard to total patient score, scars areas injected with BTX-A had significant reduction from 33.90 ± 7.46 to 11.05 ± 2.39 after six months. Also, the scars areas injected with triamcinolone showed significant mean reduction from 34.05 ± 7.72 to 14.95 ± 2.11 after six months but the results were better with BTX-A.

According to the total observer assessment scale, scars areas injected with BTX-A had significant mean reduction from 28.25 ± 6.41 to 9.75 ± 2.51 after six months. Also, the triamcinolone injected areas showed significant mean reduction from 28.25 ± 6.41 to 13.75 ± 2.57 after six months but the results were better with BTX-A.

Xiao et al, [18] injected HTSs in 19 patients (one session/ month) with intralesional BTX-A for 3 months, with at least 6 months follow-up. The overall scar was assessed and graded subjectively on a 5-point scale by plastic surgeons and the patients. The scale was as follows, 0= no improvement; 1=poor (up to 25% improvement); 2= fair (26–50% improvement); 3= good (51–75% improvement); or 4: excellent (76–100% improvement). Scar assessment by patients revealed that 12 (63%) scars had “good” improvement, and 7 scars (37%) had “excellent” improvement. The general assessment of the scars improvement by plastic surgeons revealed

that 15 scars (79%) had "good" improvement and 4 scars (21%) had "excellent" improvement.

Elhefnawy et al,[19] managed twenty patients with intralesional BTX-A as monotherapy. The overall assessment score was subjectively graded on a 5 point scale like Xiao et al [18]. Patient assessment showed "good" improvement in 12 scars (60%) and "excellent" improvement in 8 scars (40%).The overall score of clinical response by the physician revealed that 14 scars (70%) had "good" improvement, and 6 (30%) scars had "excellent" improvement.

Shaarawy et al, [20] studied the effect of BTX-A compared with corticosteroid intralesional injection therapy in 24 patients with keloids. The patients received a session of intralesional corticosteroid injection every 4 weeks for 6 sessions and then other group received intralesional injection of BTX-A every eight weeks for three sessions. Redness, elevation, and hardness (objective items), together with pain, itching, and tenderness (subjective parameters) were assessed and documented on scale from (0 to 3) where the score 0 gives minimum complaint and score 3 gives maximum complaint. No significant difference was noted between the 2 groups in most of the measured parameters. However, the BTX-A group reported higher satisfaction of the patients with their therapy with better scores. Authors proposed that BTX-A might have reduced small-fiber neuropathy causing itching, pain, and allodynia. [20-22]

At this study, according to Patient scale assessment of itching, scars areas injected with BTX-A had significant mean reduction of itching from 7.10 ± 1.37 to 1.25 ± 0.44 and mean reduction of pain from 2.90 ± 2.79 to 1.25 ± 0.55 after 6 months. Also, scars areas injected with steroids showed significant reduction of itching from 7.10 ± 1.37 to 1.75 ± 0.64 and mean reduction of pain from 2.90 ± 2.79 to 1.25 ± 0.44 after 6 months.

This agrees with Shaarawy et al, [20] Itching at that study before treatment with BTX-A was 2.25±0.86 and after treatment 0.25±0.49. Pain at that study before treatment with BTX-A was 2.5±0.674 and after treatment 0.33±0.49. Itching after the treatment with steroid was reduced from 2.67 ± 0.49 to 0.92 ± 0.66 and the pain reduces from 2.67 ± 0.651 to 1 ± 0.738.

Also this goes with, Akhtar et al,[23] who investigated the effectiveness of BTX-A in treatment of post burn scars itching . They used a visual analogue scale to assess the severity of the itching, with a score of 1 being probably nonexistent, to 10 being worst. They found that 87.5% of patients had a burn itch as severe (>7). Following the injection of BTX-A, itching intensity decreased to 1 within 4 weeks. The average duration of the symptom-free period was nine months (range 3–18 months).

At this study, scars areas injected with BTX-A had significant mean erythema reduction from 5.55 ± 2.42 to 1.85 ± 0.88. At Elhefnawy [19] study, Erythema improved from 3.2±0.78 to 1.0±0.66, on a 5-point scale, by using BTX-A. At Xiao et al [18] study, the mean erythema score improved from 3.41 to 1.23 on a 5-point scale.

At this study and according to observer assessment of induration (pliability), scars injected with BTX-A had reduction of induration from 5.50 ± 1.73 to 1.9 ± 0.55. Also, triamcinolone showed significant reduction of induration from 5.50 ± 1.73 to 2.75 ± 0.79 but the results were better with BTX-A. At Elhefnawy,[19] pliability also was graded on a 5-point scale. Lesion softening was noted and score improved from 3.3±0.48 to 0.80±0.42. At Xiao et al, [18] Pliability score was improved from 3.85 to 0.78.

At this study, according to side effects of injection, there was skin atrophy at site of injection of triamcinolone group seen in 4 patients (20%) and hypopigmentation in 6 patients (30%). The BTX-A injection sites showed no complications.

This goes with Shaarawy et al, [20] who revealed that intralesional injection of BTX-A was more favorable due to the absence of side effects, whereas skin atrophy and telangiectasia were reported in 3 patients (25%) of those receiving the intralesional corticosteroid injection. It goes also with Xiao et al, [18] Elhefnawy, [19] and Tawfik et al[24] with no complications after using BTX-A.

This study had some limitations. The follow-up period was only 6 months. Therefore, this study lacked data on long-term therapeutic effects and recurrence may occur at later times. The results of this study were obtained for only 20 patients so larger sample size with double blinded with separate control group will be more accurate.

Disclosure of potential conflicts of interest

All authors have approved the final article and its results. This work has no conflict of interests nor specific financial interests

CONCLUSION

In conclusion, intralesional injection of botulinum toxin type A is suitable for treatment of recent hypertrophic scars improving the general appearance with decreasing associated pain and itching and better tolerated than corticosteroid. Botulinum toxin type A is a promising modality for the treatment of hypertrophic scars with minimal side effects.

REFERENCES

1.Broughton G, 2nd, Janis JE, Attinger CE. The basic science of wound healing. Plastic and reconstructive surgery. 2006;117(7 Suppl):12s-34s.

2.Gosain A, DiPietro LA. Aging and wound healing. World journal of surgery. 2004;28(3):321-6.

3.Falanga V, Iwamoto S. Chapter 248. Mechanisms of Wound Repair, Wound Healing, and Wound Dressing. In: Goldsmith LA, Katz SI, Gilchrest BA, Paller AS, Leffell DJ, Wolff K, editors. Fitzpatrick's Dermatology in General Medicine, 8e. New York, NY: The McGraw-Hill Companies; 2012.

4.Sundaramurthi D, Krishnan UM, Sethuraman S. Electrospun Nanofibers as Scaffolds for Skin Tissue Engineering. Polymer Reviews. 2014;54:348 - 76.

5.Roques C, Téot L. The use of corticosteroids to treat keloids: a review. The international journal of lower extremity wounds. 2008;7(3):137-45.

6.Leventhal D, Furr M, Reiter D. Treatment of keloids and hypertrophic scars: a meta-analysis and review of the literature. Archives of facial plastic surgery. 2006;8(6):362-8.

7.Carroll LA, Hanasono MM, Mikulec AA, Kita M, Koch RJ. Triamcinolone stimulates bFGF production and inhibits TGF-beta1 production by human dermal fibroblasts. Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al]. 2002;28(8):704-9.

8.Morelli Coppola M, Salzillo R, Segreto F, Persichetti P. Triamcinolone acetonide intralesional injection for the treatment of keloid scars: patient selection and perspectives. Clinical, cosmetic and investigational dermatology. 2018;11:387-96.

9.Khatery BHM, Hussein HA, Abd-El-Raheem TA, El Hanbuli HM. Assessment of intralesional injection of botulinum toxin type A in hypertrophic scars and keloids: Clinical and pathological study. 2022;35(10):e15748.

10.Viera MH, Amini S, Valins W, Berman B. Innovative therapies in the treatment of keloids and hypertrophic scars. The Journal of clinical and aesthetic dermatology. 2010;3(5):20-6.

11.Zhang W, Li X, Li X. Efficacy and Safety of Botulinum Toxin Type A in Preventing Postoperative Scars and Improving the Cosmetic Appearance of Scars: A Systematic Review and Meta-Analysis. Journal of cutaneous medicine and surgery. 2020;24(6):608-18.

12.Ogawa R, Okai K, Tokumura F, Mori K, Ohmori Y, Huang C, et al. The relationship between skin stretching/contraction and pathologic scarring: the important role of mechanical forces in keloid generation. Wound repair and regeneration : official publication of the Wound Healing Society [and] the European Tissue Repair Society. 2012;20(2):149-57.

13.Hao R, Li Z, Chen X, Ye W. Efficacy and possible mechanisms of Botulinum Toxin type A on hypertrophic scarring. 2018;17(3):340-6.

14.Jeong HS, Lee BH, Sung HM, Park SY, Ahn DK, Jung MS, et al. Effect of Botulinum Toxin Type A on Differentiation of Fibroblasts Derived from Scar Tissue. Plastic and reconstructive surgery. 2015;136(2):171e-8e.

15.Xiao Z, Zhang F, Lin W, Zhang M, Liu Y. Effect of botulinum toxin type A on transforming growth factor beta1 in fibroblasts derived from hypertrophic scar: a preliminary report. Aesthetic plastic surgery. 2010;34(4):424-7.

16.Xiao Z, Zhang M, Liu Y, Ren L. Botulinum toxin type a inhibits connective tissue growth factor expression in fibroblasts derived from hypertrophic scar. Aesthetic plastic surgery. 2011;35(5):802-7.

17.van de Kar AL, Corion LU, Smeulders MJ, Draaijers LJ, van der Horst CM, van Zuijlen PP. Reliable and feasible evaluation of linear scars by the Patient and Observer Scar Assessment Scale. Plastic and reconstructive surgery. 2005;116(2):514-22.

18.Xiao Z, Zhang F, Cui Z. Treatment of hypertrophic scars with intralesional botulinum toxin type A injections: a preliminary report. Aesthetic plastic surgery. 2009;33(3):409-12.

19.Elhefnawy AM. Assessment of intralesional injection of botulinum toxin type A injection for hypertrophic scars. Indian journal of dermatology, venereology and leprology. 2016;82(3):279-83.

20.Shaarawy E, Hegazy RA, Abdel Hay RM. Intralesional botulinum toxin type A equally effective and better tolerated than intralesional steroid in the treatment of keloids: a randomized controlled trial. 2015;14(2):161-6.

21.Kretschmer A, Moepert K, Dames S, Sternberger M, Kaufmann J, Klippel A. Differential regulation of TGF-beta signaling through Smad2, Smad3 and Smad4. Oncogene. 2003;22(43):6748-63.
22.Rolfe KJ, Richardson J, Vigor C, Irvine LM, Grobbelaar AO, Linge C. A role for TGF-beta1-induced cellular responses during wound healing of the non-scarring early human fetus? The Journal of investigative dermatology. 2007;127(11):2656-67.
23.Akhtar N, Brooks P. The use of botulinum toxin in the management of burns itching: preliminary results. Burns : journal of the International Society for Burn Injuries. 2012;38(8):1119-23.
24.Tawfik AA, Ali RA. Evaluation of botulinum toxin type A for treating post burn hypertrophic scars and keloid in children: An intra-patient randomized controlled study. Journal of cosmetic dermatology. 2023;22(4):1256-60.

To Cite :

Gomaa, A., Elbadawy, M., Abbady, M., Aboelnaga, A. Comparison between Intralesional Injection of Botulinum Toxin A and Triamcinolone in Management of Recent Hypertrophic Scars. *Zagazig University Medical Journal*, 2024; (386-395): -. doi: 10.21608/zumj.2023.250902.3015