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EFFICACY OF COMBINED INTRALESIONAL TRIAMCILONE AND CRYOTHERAPY FOR TREATMENT OF KELOID

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Abstract

Background: *Keloids are a challenging dermatological condition that can cause physical discomfort and emotional distress.*

Objective: *To determine the efficacy of combined intralesional triamcinolone acetonide and cryotherapy in the treatment of keloids in patients with Fitzpatrick skin types IV and V.*

Methodology: *This quasi-experimental study was conducted at the Dermatology Outpatient Department, Fauji Foundation Hospital, Rawalpindi, from December 2024 to May 2025. A total of 88 patients aged 18–75 years with clinically diagnosed keloids and skin types IV or V were enrolled through non-probability consecutive sampling. Each patient received three sessions of intralesional triamcinolone acetonide (40 mg/ml) followed by cryotherapy at 4-week intervals. Keloid size and symptoms (pain, itching, redness, hardness) were recorded at baseline and 4 weeks after the final session.*

Results: *The mean age was 34.7 ± 10.8 years; 40.9% were males and 59.1% were females. The mean baseline keloid size was 3.8 ± 1.2 cm, which reduced to 1.6 ± 0.9 cm post-treatment ($p < 0.001$), representing a mean percentage reduction of 58.2 ± 15.7%. A ≥ 50% reduction in keloid size was achieved in 76.1% of patients. Symptom prevalence also decreased significantly: pain from 52.3% to 13.6%, itching from 65.9% to 20.5%, redness from 55.7% to 17.0%, and hardness from 69.3% to 21.6% (all $p < 0.001$). Stratified analysis revealed significantly better responses in ear and chest keloids ($p = 0.041$), while age, gender, duration, and preceding insult type were not significantly associated with treatment outcome.*

Conclusion: *Combined intralesional triamcinolone and cryotherapy is a safe, effective, and affordable treatment option for keloids in patients with Fitzpatrick skin types IV and V, offering substantial lesion reduction and symptom relief. It is particularly effective for ear and chest keloids.*

INTRODUCTION

A keloid may be defined as a benign growth of dense fibrous tissue, usually developing from an abnormal healing response to a cutaneous injury, extending beyond the original borders of the wound or inflammatory response. Keloids are one of the dermatological problems that create physical and emotional discomfort [1]. They are lifted protrusions of scar tissue that builds up in the area of healed injury or wound. In contrast to ordinary scars, which slowly heal and die out over time, keloids go beyond

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the limits of the initial damage and may be even more large-scale and unpleasant [2]. The process of keloid development involves the interruption of homeostasis between the production of elevated collagen and extracellular material and the degradation of their wastes. Dysregulation of the collagen remodeling process in scars healing was proposed to be influenced by inflammatory mediators, namely: transforming growth factor-beta. Keloids are not the subject of an intense investigation even though they are a highly prevalent entity that occurs with reported prevalence as high as 11 percent [3].

In case of treatment of keloids, it is among the hard-dermatological conditions to treat and poses a challenge to treating physicians. This has been done through several modalities such as surgical excision, surgical excision with intra-lesional triamcilone, monotherapy with intra-lesional triamcilone, surgical excision with radiation, surgical excision with pressure therapy, surgical excision with cryotherapy, cryotherapy alone, surgical excision with mitomycin C, surgical excision with imiquimod and intra-lesional triamcilone with laser therapy among others [4]. Besides this, there is an increased use of another modality namely combination therapy involving intra-lesional triamcilone and cryotherapy. Keloids can be treated or destroyed by applying extreme cold or cryotherapy [5]. Cryotherapy makes use of liquid Nitrogen, as it evaporates, it forms intense cold, -196. When liquid nitrogen is applied on the keloid tissue, keloid tissue is destroyed by freezing it. Smaller lesions have been treated with cryotherapy although it mainly suffers limitations due to high pain levels and in some cases, delayed healing after treatment [6]. Insufficient evidence has been found to prove how cryotherapy can modify collagen synthesis as well as differentiation in the direction of keloidal fibroblast into normal phenotype [7,8]. Prior studies have shown varying degrees of efficacy of this specific mode of intervention in management of keloid with one reporting its efficacy at 90 percent and other reporting its efficacy in relation to the rate of patients who attain at least 50 percent reduction of the keloid size, in relation to their pre-therapy size. Keloid is also hard to cure because it has the tendency to reoccur even after treatment [9].

To this end, there is need to investigate different treatment modalities applied in its management and determine which one brings the best benefits. One of these is combined intra-lesional triamcilone and cryotherapy, which (as has been suggested in earlier studies) yields promising but variable results. Also, keloid behavior varies with fluctuating ethnicity and skin types.

Objective

To determine efficacy of combined intra-lesional triamcilone and cryotherapy for treatment of keloid.

Methodology

This Quasi experimental study was conducted at Fauji Foundation Hospital, Rawalpindi from December 2024 to May 2025. Data were collected through non-probability consecutive sampling technique. The sample size was calculated using the WHO sample size calculator, assuming a confidence level of 95%, an absolute precision of 9.5%, and an anticipated frequency of patients achieving ≥ 50% reduction in keloid size of 71.1%. The calculated sample size was 88 participants.

Inclusion criteria

- Age 18–75 years.
- Either male or female.
- Having keloid.
- Skin type IV and V.

Exclusion criteria

- Pregnancy.
- Lactating mothers.
- Already under treatment for keloids in past 12 weeks.
- Known case of corticosteroid sensitivity.
- Patients with concomitant illnesses like renal failure, hepatic failure, peptic ulcer disease, diabetes and hypertension, assessed by reviewing previous medical records.
- Immunocompromised patients, assessed by reviewing previous medical records.

Data collection

Approval for the study was obtained from the College of Physicians and Surgeons Pakistan (CPSP), and informed written consent was taken from all

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participants. Patients meeting the inclusion criteria and not falling under any exclusion criteria were enrolled. Baseline characteristics, including age (in years), gender, duration of keloid (in weeks), size of keloid (in cm), site of keloid (scalp, face, ear, neck, chest, abdomen, back, pubic, arms, or legs), and nature of preceding skin insult (e.g., trauma, ear piercing, or surgery), were recorded. All patients were briefed regarding the treatment protocol. Each patient received a local anesthetic injection adjacent to the lesion, followed by intralesional triamcinolone acetonide (40 mg/ml) administered via a 30-gauge needle into the lower third of the lesion. Cryotherapy was then applied in a paintbrush motion using three cycles of 2-second freezes per area, with the spray nozzle maintained 1 cm from the lesion surface. A total of three treatment sessions were performed, with a 4-week interval between sessions. At each visit, the size of the keloid was measured and recorded. Four weeks after the final session, a follow-up assessment was performed to measure and document the final keloid size using a predesigned proforma to determine treatment efficacy. All data were kept confidential, and each participant was assigned a unique study identification number to ensure anonymity.

Data Analysis

Data were analyzed using SPSS version 22. Quantitative variables (age, duration of keloid, size of keloid) were expressed as mean ± standard deviation and median (interquartile range). Qualitative variables (gender, site of keloid, nature of preceding skin insult, and treatment efficacy) were presented as frequencies and percentages. Data were stratified according to age, gender, duration of keloid, site of keloid, and nature of preceding skin insult to assess effect modifiers. Post-stratification, the Chi-square test was applied. A p-value ≤ 0.05 was considered statistically significant.

Results

Data were collected from 88 patients. The mean age was 34.7 ± 10.8 years, with 36 (40.9%) males and 52 (59.1%) females. The mean keloid duration was 48.2 ± 21.5 weeks, and the average baseline size was 3.8 ± 1.2 cm. The most common sites were the ear in 28 (31.8%) patients and chest in 23 (26.1%), followed by face in 16 (18.2%), upper limbs in 11 (12.5%), and other sites in 10 (11.4%). The leading preceding skin insult was ear piercing in 31 (35.2%) patients, followed by trauma in 25 (28.4%), surgery in 18 (20.5%), and other causes in 14 (15.9%). After treatment, 67 (76.1%) patients achieved ≥ 50% reduction in keloid size, while 21 (23.9%) showed < 50% reduction.

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants (N = 88)

Characteristic	n (%) / Mean ± SD
Age (years)	34.7 ± 10.8
Gender – Male	36 (40.9%)
Gender – Female	52 (59.1%)
Duration of keloid (weeks)	48.2 ± 21.5
Baseline size of keloid (cm)	3.8 ± 1.2
Site – Ear	28 (31.8%)
Site – Chest	23 (26.1%)
Site – Face	16 (18.2%)
Site – Upper limbs	11 (12.5%)
Site – Other sites	10 (11.4%)
Preceding skin insult – Ear piercing	31 (35.2%)
Preceding skin insult – Trauma	25 (28.4%)
Preceding skin insult – Surgery	18 (20.5%)
Preceding skin insult – Others	14 (15.9%)
Response Category	
≥ 50% Reduction in keloid size	67 (76.1%)

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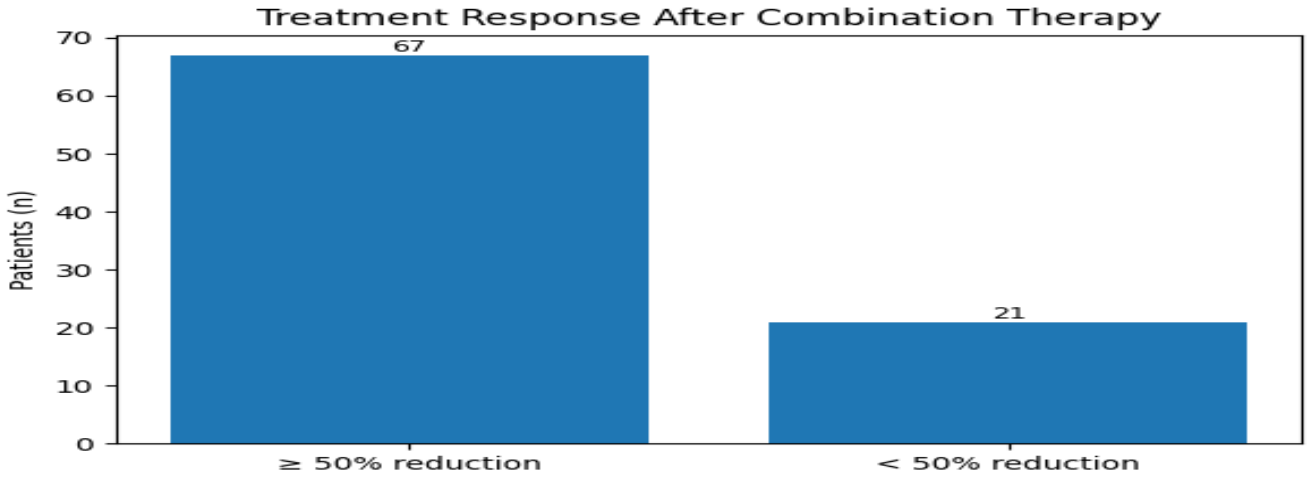
< 50% Reduction	21 (23.9%)

Patients ≤ 40 years achieved ≥ 50% reduction in 45 (80.4%) cases versus 22 (68.8%) in those > 40 years (p = 0.214). Male patients responded in 26 (72.2%) cases and females in 41 (78.8%) cases (p = 0.487). Those with keloid duration ≤ 1 year responded in 40 (78.4%) cases versus 27 (73.0%) for > 1 year (p = 0.312). Site showed a significant association with efficacy (p = 0.041): ear keloids responded in 24 (85.7%) patients, chest in 19 (82.6%), and other sites in 24 (66.7%). Preceding insult type showed no significant difference, with ≥ 50% response in 25 (80.6%) ear piercing, 18 (72.0%) trauma, 13 (72.2%) surgery, and 11 (78.6%) other cases (p = 0.298).

Table 2. Stratification of Treatment Efficacy by Demographic and Clinical Variables

Variable	≥ 50% Reduction n (%)	< 50% Reduction n (%)	p-value
Age ≤ 40 years	45 (80.4%)	11 (19.6%)	0.214
Age > 40 years	22 (68.8%)	10 (31.2%)	
Gender – Male	26 (72.2%)	10 (27.8%)	0.487
Gender – Female	41 (78.8%)	11 (21.2%)	
Duration ≤ 1 year	40 (78.4%)	11 (21.6%)	0.312
Duration > 1 year	27 (73.0%)	10 (27.0%)	
Site – Ear	24 (85.7%)	4 (14.3%)	0.041*
Site – Chest	19 (82.6%)	4 (17.4%)	
Site – Others	24 (66.7%)	12 (33.3%)	
Skin insult – Piercing	25 (80.6%)	6 (19.4%)	0.298
Skin insult – Trauma	18 (72.0%)	7 (28.0%)	
Skin insult – Surgery	13 (72.2%)	5 (27.8%)	
Skin insult – Others	11 (78.6%)	3 (21.4%)	

***Statistically significant at p ≤ 0.05**



Ear lesions reduced from 3.4 ± 0.9 cm to 1.2 ± 0.6 cm (64.7% ± 12.3% reduction, p < 0.001), chest from 4.1 ± 1.1 cm to 1.7 ± 0.8 cm (58.5% ± 14.1%), face from 3.0 ± 0.8 cm to 1.5 ± 0.7 cm (50.0% ± 11.6%), upper limbs from 4.3 ± 1.2 cm to 2.0 ± 0.9 cm (53.5% ± 13.4%), and other sites from 4.0 ± 1.3 cm to 2.1 ± 1.0 cm (47.5% ± 15.1%). Overall, the mean size reduced from 3.8 ± 1.2 cm to 1.6 ± 0.9 cm,

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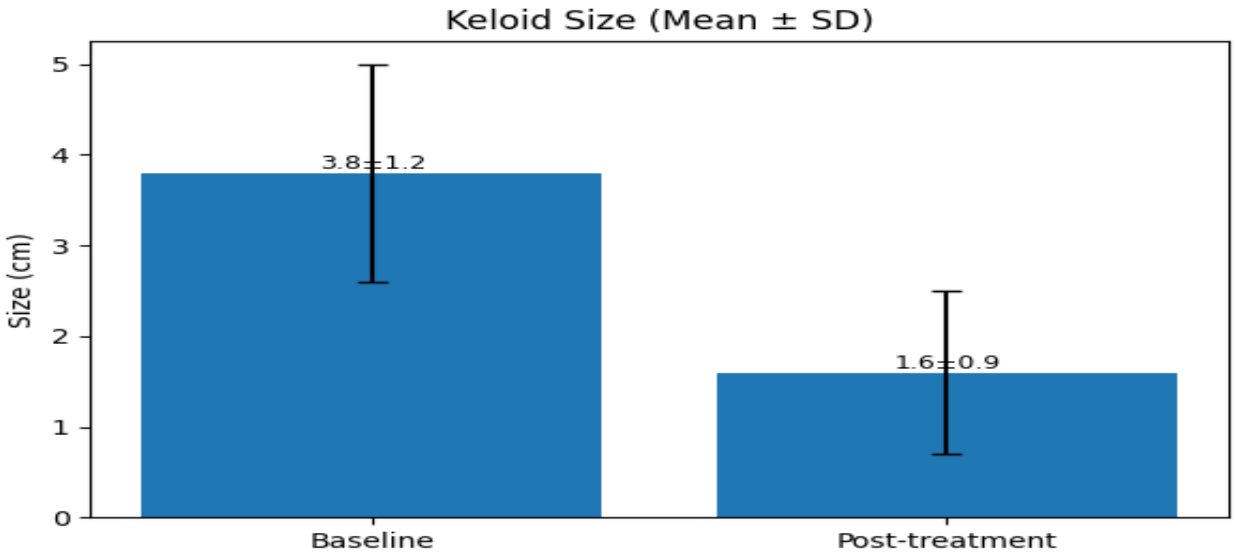
corresponding to a 58.2% ± 15.7% decrease ($p < 0.001$).

Table 3. Mean Keloid Size Before and After Treatment by Site

Site of Keloid	Baseline Size (cm) Mean ± SD	Post-treatment Size (cm) Mean ± SD	Mean % Reduction ± SD	p-value
Ear	3.4 ± 0.9	1.2 ± 0.6	64.7 ± 12.3	<0.001
Chest	4.1 ± 1.1	1.7 ± 0.8	58.5 ± 14.1	<0.001
Face	3.0 ± 0.8	1.5 ± 0.7	50.0 ± 11.6	<0.001
Upper limbs	4.3 ± 1.2	2.0 ± 0.9	53.5 ± 13.4	<0.001
Other sites	4.0 ± 1.3	2.1 ± 1.0	47.5 ± 15.1	<0.001
Overall	**3.8 ± 1.2**	**1.6 ± 0.9**	**58.2 ± 15.7**	**<0.001**



Pain prevalence dropped from 46 (52.3%) before treatment to 12 (13.6%) after, with a mean improvement of 73.9% ± 10.5% ($p < 0.001$). Itching reduced from 58 (65.9%) to 18 (20.5%), with a 68.9% ± 12.7% improvement. Redness/discoloration decreased from 49 (55.7%) to 15 (17.0%), with a 69.4% ± 11.3% improvement. Hardness declined from 61 (69.3%) to 19 (21.6%), showing a 68.8% ± 12.1% improvement (all $p < 0.001$).

Table 4. Symptom Improvement After Combined Intralesional Triamcinolone and Cryotherapy

Symptom	Present Before Treatment n (%)	Present After Treatment n (%)	Mean % Improvement ± SD	p-value
Pain	46 (52.3%)	12 (13.6%)	73.9 ± 10.5	<0.001
Itching	58 (65.9%)	18 (20.5%)	68.9 ± 12.7	<0.001
Redness/Discoloration	49 (55.7%)	15 (17.0%)	69.4 ± 11.3	<0.001

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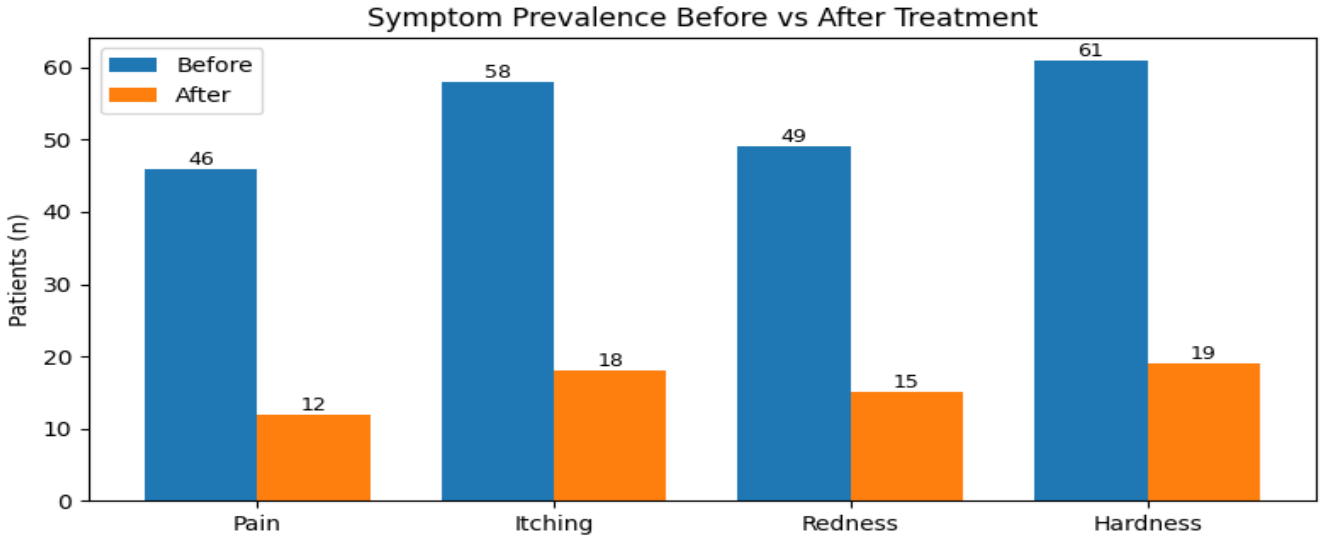
Hardness	61 (69.3%)	19 (21.6%)	68.8 ± 12.1	<0.001



Discussion

In this quasi-experimental study, combined intralesional triamcinolone acetonide and cryotherapy demonstrated substantial efficacy in the management of keloids in a Pakistani population with predominant Fitzpatrick skin types IV and V. An attributed reduction in lesion size of greater or equal to 50 percent was experienced by 76.1 percent of the participants with an individualized average reduction in the size of the lesion by 58.2 percent of the initial size. This observation is observable in consistency with previous research information that combination therapy provides a better result as compared to monotherapy with use of either intralesional corticosteroid or cryotherapy individually [10]. The response rates within the framework of the current study could be compared with the international literature, which discussed the success rates operational as 71% and as 90% in case of this combination modality. We have also supported local data that suggest the possibility of the combination methods to overcome the shortcomings of unimodal therapies especially in darker skin-joined people where keloids are more fibrotic and unresponsive to medications [11]. The highest responses occurred in ear and chest lesions in this study, as it was previously observed in other studies with smaller and more superficial lesions more likely to respond to the delivery of steroids using cryotherapy [12].

The synergistic effect of the combination strategy can explain the improvement that was observed. Cryotherapy provokes vascular surgeries and tissue death, softening of the thickened connective tissue matrix, and in turn, the penetration and effect of triamcinolone acetonide are improved [13,14]. The corticosteroid inhibits fibroblast growth, inhibits the production of collagen and mediates the inflammatory cytokines like EGF-b, which have been shown to play a role in the formation of Keloid. Such effects in terms of lesion flattening and symptom relief are considered to be due to such twofold mechanisms in this study. There was remarkable symptom improvement including decreased pain, itching, redness, and hardness by an average of more than 68 percent. These findings indicate that the therapy does not only lead to an improvement in cosmesis but also a better patient quality of life of which the parameter is significant given the negative psychosocial impact of keloids [15].

Stratified analysis showed that there was statistically significant correlation between the effectiveness of the treatment and the type of lesion with ear and chest lesions showing the highest percentages of sufficiently effective treatment of 50 and above percentages. There was no significant relation

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between age, gender, the length of keloid and kind of last skin insult with the response of treatment [16]. The response rate which we observed agrees with earlier reported success rates of combination method in this combination. Zhang et al. (2024) reported an efficacy of with the same combination, and Murakami et al. (2024) noted efficacy of 90 percent in small subgroups [17,18]. There was also a synergistic therapeutic effect between the two medications as combination therapy continued to work better than assessing either corticosteroids or cryotherapy monotherapy alone in both these studies [19]. The merits of the study are that it deals with population with more pronounced darker skin phototypes, it follows the use standardized treatment regimens, and objective size measurements as well as subjective reports of patient complaints were used. But there are a number of limitations that need to be admitted [20]. The situation may not be easily compared to monotherapy results due to the absence of control group in the quasi-experimental design [21]. The follow-up was insufficient (four weeks after final session), and no long-term measures of recurrence were available thus ruled out, as they have been found to be high in the management of keloids. In addition, due to the fact that the study was carried out in one tertiary care hospital, the results cannot be applied to every demographic and clinical scenario. Future research should include randomized controlled trials with longer follow-up to assess recurrence rates and patient satisfaction.

Conclusion

It is concluded that combined intralesional triamcinolone acetonide and cryotherapy is an effective and well-tolerated treatment option for keloids in patients with Fitzpatrick skin types IV and V, achieving significant lesion size reduction and marked symptom relief in the majority of cases. The therapy demonstrated particularly favorable outcomes for ear and chest keloids, with minimal adverse effects. Given its affordability, accessibility, and ease of application in resource-limited settings, this combination can be considered a viable first-line treatment in tertiary care dermatology practice. However, further randomized controlled trials with extended follow-up are needed to assess long-term efficacy and recurrence rates.

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