COMPARATIVE STUDY OF TWO CONCENTRATIONS (2.5 MG/mL AND 5 MG/mL) OF INTRALESIONAL TRIAMCINOLONE ACETONIDE IN THE TREATMENT OF ALOPECIA AREATA

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ABSTRACT

Objectives: To compare the efficacy and safety between two concentrations (2.5 mg/mL versus 5 mg/mL) of intralesional triamcinolone acetonide (TAC) for the treatment of alopecia areata (AA).

Materials and methods: Sixty patients with AA were divided into two groups. The group receiving 2.5 mg/mL included 30 patients, while the group receiving 5 mg/mL also included 30 patients. Both groups were treated with monthly TAC injections for three sessions. The response rate (based on changes in the area of hair loss, SALT score, and trichoscopy findings) and side effects were compared between the two groups after completing the three treatment sessions.

Results: The differences in hair loss area and SALT scores between the two groups were not statistically significant after 12 weeks. However, terminal hair regrowth and hair density improvement were observed in 40.7% and 59.3% of patients receiving 5 mg/mL, compared to 27.9% and 42.7% of those receiving 2.5 mg/mL ($p < 0.05$). Adverse effects were more common in the group receiving 5 mg/mL (43.4%) compared to the group receiving 2.5 mg/mL (20%) at 12 weeks.

Conclusions: Intralesional injection of triamcinolone acetonide at 2.5 mg/mL is as effective and safe as 5 mg/mL in the treatment of patchy alopecia areata. However, TAC 5 mg/mL appears to be more effective in promoting terminal hair regrowth and increasing hair density.

Keywords: *Alopecia areata, triamcinolone acetonide, TAC*.

INTRODUCTION

Alopecia areata (AA) is considered an autoimmune disorder with an estimated prevalence of approximately 0.2% globally. Although the disease is usually indolent, it often results in significant cosmetic disfigurement and negatively impacts patients' psychological well-being and quality of life.[1,2,3,4]

AA may spontaneously resolve, particularly in cases with mild disease and a disease duration of less than one year, with the remission rate of up to 80%.[2,5,6,7] The choice of treatment for alopecia areata mainly depends on disease severity.[2,5,7,8] Topical therapies are commonly used for limited patchy hair loss (involving less than 50% of the scalp).[2,5,7,8] According to current guidelines,

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intralesional corticosteroid injection is considered the first-line treatment for localized forms of alopecia areata.[5,6,7]

The efficacy of triamcinolone acetonide has been extensively studied, including comparisons with other corticosteroids.[9] Among these agents, triamcinolone acetonide is more commonly preferred and widely adopted in clinical practice.[9] However, intralesional corticosteroid injections are associated with several local adverse effects, including injection site pain, skin atrophy, telangiectasia, hypopigmentation or depigmentation, and localized infections. In some cases, systemic side effects may also occur, such as menstrual irregularities in women and features of cushing's syndrome…[9,10,11,12] Most studies consistently recommend administering a volume of approximately 0.1 ml per injection site, spaced 1 cm apart. However, there is a considerable variation in the concentration of corticosteroids used across different studies.[9,13,14] Therefore, this study was conducted to compare the therapeutic outcomes of intralesional triamcinolone acetonide at concentrations of 2.5 mg/mL and 5 mg/mL in the treatment of alopecia areata.

MATERIALS AND METHODS

STUDY POPULATION

Patients diagnosed with alopecia areata who presented for examination and treatment at the Department of Research and Application of Stem Cell Technology from January 2022 to March 2024 were recruited in our study.

Inclusion criteria: Patients aged ≥ 18 years were diagnosed with alopecia areata based on the following criteria: Clinical examination: one or more round or oval patches of hair loss; the scalp in the affected area is smooth, non-pruritic, and no scaling; imaging findings for differential diagnosis in suspected cases: Trichoscopy examination with characteristic findings such as exclamation mark hairs, yellow dots, black dots, and vellus hair; limited patchy alopecia areata (defined as involvement of less than 50% of the scalp surface area); no topical or systemic treatment for alopecia areata, or for other conditions with potential therapeutic effects on alopecia areata within the past 3 months.

Exclusion criteria: Pregnant or breastfeeding women; known hypersensitivity to local anesthetics or to any ingredient of the medication coagulation disorders or receiving anticoagulant therapy; autoimmune connective tissue diseases, active infection at the site of hair loss, or chronic internal diseases including hypertension, diabetes, cardiovascular disease, renal failure, hepatic failure, or severe immunodeficiency; fungal infections at the lesion site.

Study design

This was a prospective comparative clinical trial with a parallel-group design, conducted from January 2022 to March 2024.

Study procedures

Patients enrolled in the study underwent clinical examination, trichoscopy of both alopecic lesions and adjacent normal scalp areas, and direct microscopic examination (KOH preparation) of lesion samples. Patients were pair-matched distributed into two groups with comparable baseline characteristics relevant to disease status. The group 1 received intralesional injections of triamcinolone acetonide (TAC) at a concentration of 2.5 mg/mL, while the group 2 received TAC at a concentration of 5 mg/mL. Injections were administered intradermally at a dose of 0.1 ml per site spaced 1 cm apart. Each patient received three treatment sessions at 4-week intervals, with a maximum total TAC dose of 40 mg per session. In addition, all patients received oral supplementation with biotin and zinc. Treatment outcomes were assessed at weeks 4, 8, and 12.

Study materials

Triamcinolone acetonide 80 mg/2 mL suspension (Kenacort Retard), manufactured by Bristol-Myers Squibb. Lidocaine hydrochloride 2% 10 mL manufactured in Hungary which was used as the diluted solution. Fucidin antibiotic cream manufactured by LEO Pharma, Denmark. B-Braun. Fotofinder device manufactured in Germany was employed for trichoscopy examination. Square grid ruler with each square measuring 1 cm^2.

Evaluation of treatment outcomes

Evaluation of response, SALT score, hair density, terminal hair ratio, and the proportion of dermoscopic features including exclamation mark hairs, black dots, and yellow dots, as well as adverse effects, was performed at baseline and at weeks 4, 8, and 12.

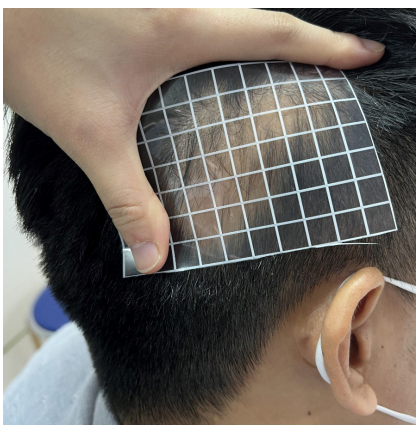


Figure 1. Square grid ruler with an area of 1 cm^2

Figure 2. TAC injection at the lesion site

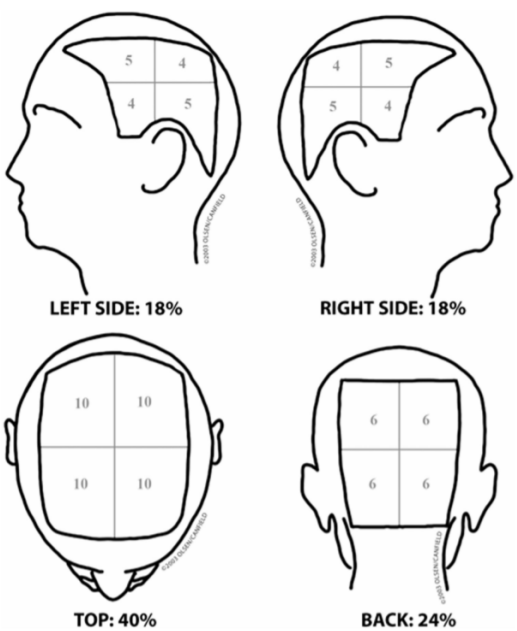


Figure 3. Assessment of SALT score

Assessment of SALT (Severity of Alopecia Tool Score): The scalp is divided into four quadrants and the percentage of hair loss in each area is visually estimated. The percentage of hair loss in each quadrant = calculated as the percentage of hair loss multiplied x the percentage of total scalp surface area represented by that quadrant. The final SALT score is the sum of hair loss percentages across all scalp regions.

Assessment was performed using the response grading scale proposed by Gita & Mohammadreza in 2013. A good response: Hair regrowth > 75%. A moderate response: Hair regrowth 51% - 75%. A poor response: Hair regrowth 26% - 50%. No response: Hair regrowth 0% - 25%.

Data analysis

Statistical analyses were performed using SPSS version 22.0. The variables were expressed as mean ± SD, standard deviation, median, minimum, maximum, percentage, and frequency. Statistical tests used to compare two means included the *t*-test for variables with a normal distribution, and non-parametric tests (Wilcoxon and Mann-Whitney U or rank-sum test) for variables without a normal distribution. For categorical variables, Fisher's exact test or the Chi-square test was used. P values < 0.05 were considered statistically significant.

Ethical considerations

This study received the NHDV Institutional Review Board approval. The investigators ensured that all procedures were conducted in accordance with the declaration of Helsinki on ethical principles for medical research. All patients provided written informed consent prior to participating in the study. Patients had the right to withdraw from the study at any time without any impact on their ongoing medical treatment. Personal information of all participants was kept confidential. Patients were fully informed about the effects of the medication, monitored throughout the study, and treated in a manner that ensured no adverse impact on their health.

RESULTS

Characteristics of the study population

Table 1. Baseline characteristics of the study population (N = 60)

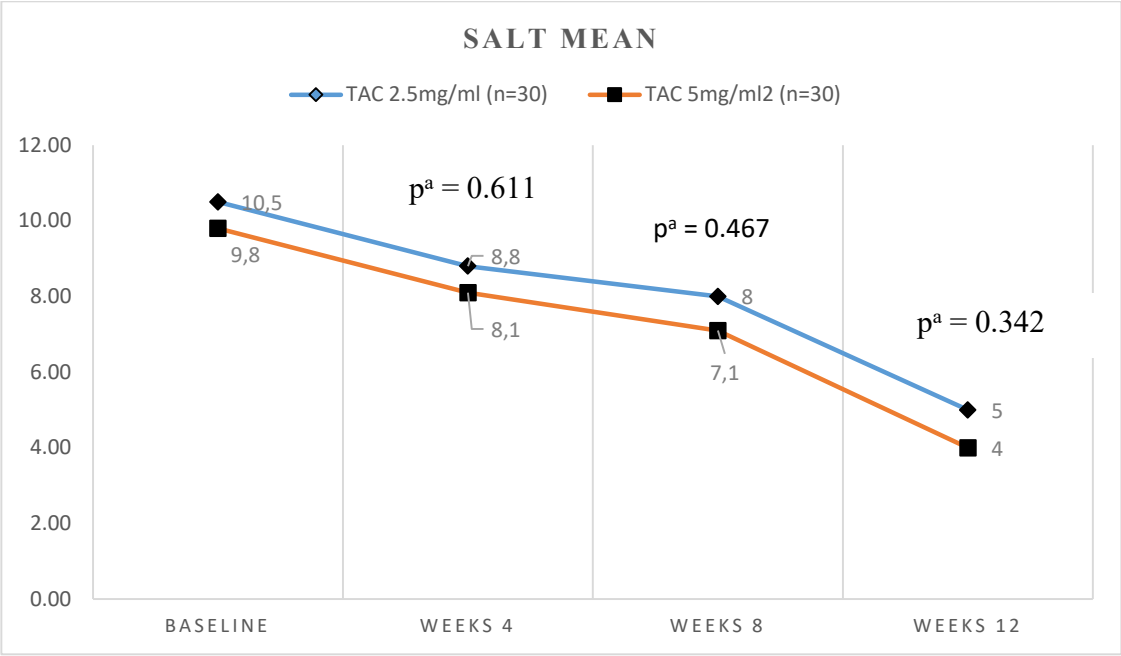
Characteristics	TAC 2.5 mg/mL group (n1 = 30)	TAC 5 mg/mL group (n2 = 30)	p - value
Age (years) $\overline{X}$ ± SD	32.4 ± 10.5	32.8 ± 11.8	0.899[a]
Disease duration (months) $\overline{X}$ ± SD	4.4 ± 2.7	6.1 ± 8.2	0.305[a]
Number of patches $\overline{X}$ ± SD	3.4 ± 1.5	2.7 ± 1.8	0.094[a]
Baseline lesion area $\overline{X}$ ± SD	14.5 ± 7.6	12.9 ± 4.6	0.32[a]
SALT score $\overline{X}$ ± SD	10.5 ± 5.3	9.8 ± 4.7	0.572[a]
Gender - n (%)			
Male	13 (43.3%)	12 (40%)	0.196[b]
Female	17 (56.7 %)	18 (60%)	

Characteristics	TAC 2.5 mg/mL group (n1 = 30)	TAC 5 mg/mL group (n2 = 30)	p - value
Past history of AA - n (%)			
Yes	4	5	0.718[c]
No	26	25	
Family history of AA - n (%)			
Yes	2	1	0.554[c]
No	28	29	

[a]Rank sum test, [b]Chi-square test, [c]Fisher's exact test.

In the group receiving intralesional TAC at a dose of 2.5 mg/mL, there were 30 patients with a mean age of 32.4 ± 10.5 years; 43.3% were male and 56.7% were female; the mean disease duration was 4.4 ± 2.7 months, and the mean number of alopecic patches was 3.4 ± 1.5. In the group receiving intralesional TAC at a dose of 5 mg/mL, there were 30 patients with a mean age of 32.8 ± 11.8 years; 40% were male and 60% were female, the mean disease duration was 6.1 ± 8.2 months, and the mean number of alopecic patches was 2.7 ± 1.8. There were no significant differences between the two groups in terms of sex distribution, mean age, mean disease duration, baseline lesion area, SALT score, or personal and family history of alopecia areata between the two groups with p > 0.05. (Table 1).

Change in mean SALT score



[a]Rank sum test.

Figure 4. Changes in mean SALT score in the two treatment groups at baseline and at weeks 4, 8, and 12 (N = 60)

The mean SALT score decreased substantially over time in both the TAC 2.5 mg/mL and TAC 5 mg/mL groups, with a statistically significant reduction ($p < 0.001$) at weeks 4, 8, and 12 compared to baseline.

Mean reduction in SALT scores in the two groups (calculated as the difference in SALT scores)

Table 2. Comparison of the mean reduction in SALT score between the two groups (calculated as the difference in SALT scores at weeks 4, 8, and 12 compared with week 0) (N = 60)

	TAC 2,5mg/mL group (n1 = 30)	TAC 5mg/mL group (n2 = 30)	p[a]
Weeks 4 ($\overline{X} \pm SD$)	1.7 ± 0.8	1.6 ± 0.3	0.527
Weeks 8 ($\overline{X} \pm SD$)	1.5 ± 0.1	2.7 ± 0.2	< 0.001
Weeks 12 ($\overline{X} \pm SD$)	5.4 ± 2.1	5.7 ± 1.3	0.522

[a]Rank sum test.

The mean SALT scores at baseline and at weeks 4, 8, and 12 showed no statistically significant differences between the two groups. However, when comparing the mean reduction in SALT scores (calculated as the difference between the scores at weeks 4/8/12 and the baseline score), the TAC 5 mg/mL group demonstrated a significantly greater reduction at week 8 ($p < 0.001$).

Change in hair density on dermoscopy

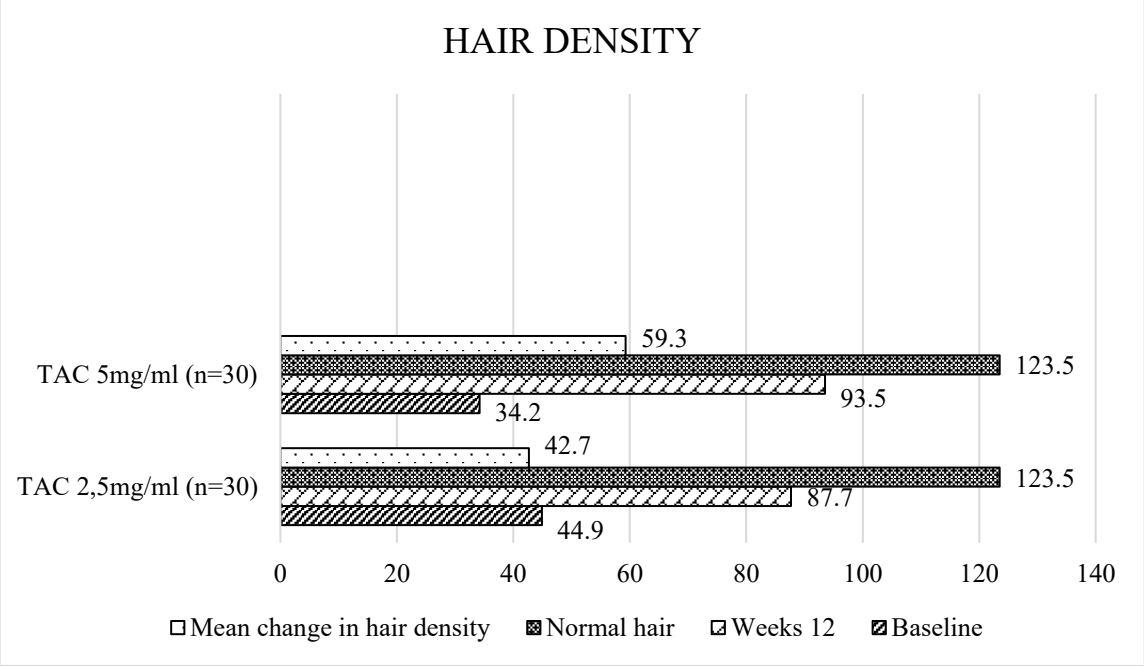


Figure 5. Change in mean hair density on dermoscopy in the two treatment groups before treatment and after 12 weeks (N = 60)

At week 12, the mean hair density in the TAC 2.5 mg/mL and TAC 5 mg/mL groups was 87.7 and 93.5, respectively, showing a marked increase compared to baseline values of 44.9 and 34.2. These differences were statistically significant ($p < 0.001$), however, the values remained lower than the hair density in adjacent normal areas and this difference was also statistically significant. The change in hair density after 12 weeks differed between the two groups, with the TAC 5 mg/mL group showing greater improvement (p = 0.018).

Change in terminal hairs on trichoscopy

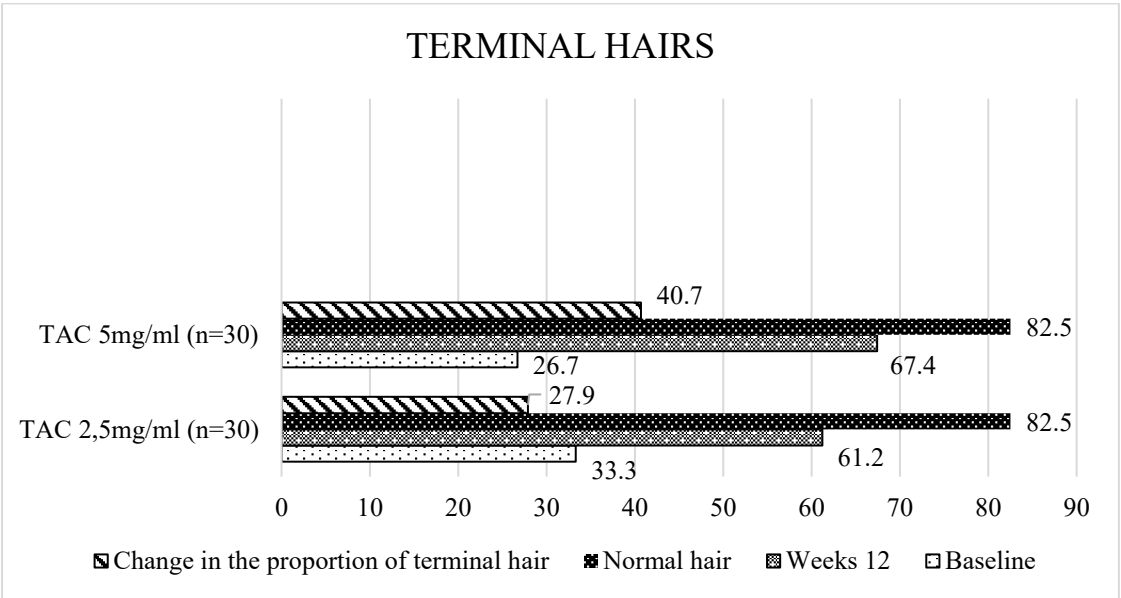
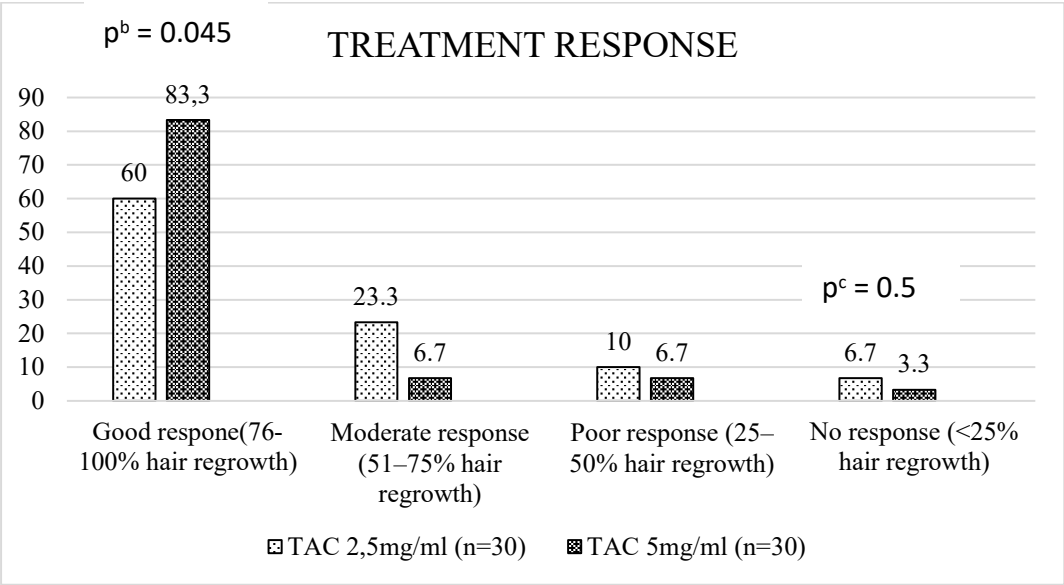


Figure 6. Change in mean terminal hair count on dermoscopy in the two treatment groups before treatment and after 12 weeks (N = 60)

At week 12, the proportion of terminal hairs in the TAC 2.5 mg/mL and TAC 5 mg/mL groups was 67.4% and 61.2%, respectively, showing a significant increase compared with baseline values of 26.7% and 33.3% ($p < 0.001$). However, these proportions were still lower than those in adjacent normal scalp areas and the differences were also statistically significant. The change in terminal hair proportion after 12 weeks compared with baseline differed between the two groups, with the TAC 5 mg/mL group achieving better improvement (p = 0.006).

Treatment response



[b]Chi-square test, [c]Fisher's exact test.

Figure 7. Evaluation of treatment response according to the grading scale of Gita and Mohammadreza 2013 (N = 60)

In the TAC 5 mg/mL group, 83.3% of patients achieved a good response, that was significantly higher than that in the TAC 2.5 mg/mL group (p = 0.045). Non-response was observed in 6.7% of patients in the TAC 2.5 mg/mL group and 3.3% in the TAC 5 mg/mL group, with no statistically significant difference between the two groups.

Adverse effects

Table 3. Adverse effects (N = 60)

Symptoms	TAC 2.5mg/mL (n1 = 30)	TAC 5mg/mL (n2 = 30)
Early		
Pain	30 (100%)	30 (100%)
Edema	0	0
Allergy	0	0
Late		
Infection	0	0
Ulcer	0	0

Symptoms	TAC 2.5mg/mL (n1 = 30)	TAC 5mg/mL (n2 = 30)
Folliculitis	4 (13.3)	5(16.7)
Pigmentary alteration	0	0
Skin atrophy	2(6.7%)	4(13.3%)
Telangiectasia	0	2(6.7%)
Menstrual irregularities	0	2/18 (11.1%)
Cushing's syndrome	0	0

In both groups, 100% of patients experienced pain at the injection site, and no patients developed allergies, edema, or infection. Folliculitis occurred in 4 out of 30 patients in the TAC 2.5 mg/mL group and in 5 out of 30 patients in the TAC 5 mg/mL group. Skin atrophy and telangiectasia were observed in 4 patients in the TAC 5 mg/mL group and in 2 patients in the TAC 2.5 mg/mL group. Only 2 patients in the TAC 5 mg/mL group experienced menstrual irregularities, and no patients in either group showed signs of Cushing's syndrome.

DISCUSSION

Intralesional corticosteroid injection at alopecia sites is still considered the first-line indication for localized patchy alopecia areata.2,6,8 Studies have shown that concentrations ranging from 2.5 mg/mL to 10 mg/mL are effective and safe; however, the optimal concentration remains a matter of debate.[9,10,12,14,15]

In this study, the distribution of sex, age at onset, disease duration, severity of hair loss (SALT score), and dermoscopic parameters before treatment was comparable between the two groups. Both groups showed a marked improvement in SALT score, hair density, terminal hair ratio, and hair regrowth at baseline and after 12 weeks of treatment. The reduction in SALT score at week 12 was also comparable between the two groups. However, when evaluating changes in hair density, terminal hair ratio, and treatment response according to the grading scale of Gita and Mohammadreza (2013), the results in the TAC 5 mg/mL group were 59.3%, 40.7%, and 83.3%, respectively, which were significantly higher than those in the TAC 2.5 mg/mL group at 42.7%, 27.9%, and 60%, respectively. These findings indicate that TAC 2.5 mg/mL yields results comparable to the 5 mg/mL dose in terms of lesion location and affected area; however, the degree of improvement in hair density and terminal hair growth is lower.

In addition, we documented adverse effects during treatment and found that 100% of patients in both groups experienced pain at the injection site, and no patients developed allergic reactions or edema immediately after injection. Late-onset adverse effects were more frequent in the TAC 5 mg/mL group, with 16.7% of patients developing folliculitis, 13.3% skin atrophy, 6.7% telangiectasia, and 6.7% menstrual irregularities, compared with the TAC 2.5 mg/mL group, in which the corresponding rates were 13.3% for folliculitis, 6.7% for skin atrophy, and no cases of telangiectasia or menstrual irregularities.

The study by Chu (2015) also demonstrated that the therapeutic efficacy of TAC injection at a concentration of 2.5 mg/mL was comparable to that of 5 mg/mL and 10 mg/mL, with fewer adverse effects observed in the 2.5 mg/mL group13. The study by Pelin Ustuner (2017) involving 89 patients compared TAC injections at three concentrations of 3.3 mg/mL, 5 mg/mL, and 10 mg/mL, and found that the mean number of injections required to achieve effectiveness was 3.74 ± 0.99. The highest success rate was observed in the 10 mg/mL group at 97.1%, followed by 87.9% in the 5 mg/mL group, both significantly higher than 56.3% in the 3.3 mg/mL group. However, the highest incidence of adverse effects was also recorded in the TAC 10 mg/mL group, including skin atrophy (86.7%), telangiectasia (71.4%), and hypopigmentation (14.3%); in TAC 5 mg/mL group, the rates were 15.4% for skin atrophy, 0% for telangiectasia, and 7.7% for hypopigmentation; in TAC 3.3 mg/mL group, skin atrophy occurred in 5.9% of patients, with no cases of hypopigmentation or telangiectasia.[12] The study by Jihan M. Muhaidat (2020) involving 85 patients divided into two groups receiving TAC at 5 mg/mL and 10 mg/mL showed comparable efficacy between the two groups; however, adverse effects were more frequently observed in TAC 10 mg/mL group.[14]

Intralesional TAC injections at concentrations of 2.5 mg/mL and 5 mg/mL in our study showed good efficacy in both groups; however, TAC 5 mg/mL group demonstrated greater improvement in hair density and hair regrowth, while also showing a higher incidence of adverse effects. These higher adverse effects were still within controllable limits. Using a lower concentration such as 2.5 mg/mL offers the advantage of achieving efficacy while balancing the reduction of local adverse effects such as skin atrophy and telangiectasia, as well as systemic effects (menstrual irregularities or Cushing's syndrome). However, future studies with a larger sample size are needed to further evaluate the safety of TAC when higher total doses are injected. In addition, our study followed patients only until week 12; therefore, recurrence could not be accurately assessed.

CONCLUSIONS

In the treatment of limited patchy alopecia areata, intralesional triamcinolone acetonide at concentrations of 2.5 mg/mL and 5 mg/mL both show good responses compared with baseline. Improvement in alopecic area and SALT score was similar between the two groups; however, improvement in hair density and terminal hair ratio was higher in the TAC 5 mg/mL group. Intralesional triamcinolone acetonide is a highly effective method in the treatment of limited patchy alopecia areata.

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Conflicts of interest: The authors declare that there is no conflict of interest.

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