Original Article

Clinical Pitfalls of Intralesional Corticosteroid Injection in Alopecia Areata by General Practitioners: A Retrospective Study

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Background: Intralesional corticosteroid injection is a treatment of choice in alopecia areata. To our knowledge, no study explored and described pitfalls of this technique.

Objective: To clarify common pitfalls of intralesional corticosteroid injection technique in alopecia areata among Thai general practitioners.

Materials and Methods: The present study was conducted by reviewing score sheets and questionnaires of 127 participants who attended the annual short courses in practical dermatology for general practitioners organized by the Dermatological Society of Thailand in 2013 and 2014. Before the workshop, preliminary practical examination was conducted. Participants were instructed to perform intralesional corticosteroid injection in alopecia areata lesion using artificial skin model and were scored by two experienced dermatologists. Intralesional corticosteroid injection technique was categorized into four components (preparation technique, medication selection, equipment selection, and injection technique).

Results: Common pitfalls among participants were inappropriate medication concentration (34.7%) and incorrect injection technique (33.9%). Physicians with more experience in intralesional corticosteroid injection demonstrated more confidence (p-value <0.05).

Conclusion: Possible reasons for incorrect injection technique are limited dermatologic curriculum hour and insufficient experience. To achieve functional competency in intralesional corticosteroid injection technique, adequate training time and practical experiences in medical school are required.

Keywords: Alopecia areata, General practitioner, Intralesional corticosteroid injection, Pitfall

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Alopecia areata [AA] is a recurrent non-scarring alopecia that commonly presents with round discrete patches of hair loss on hair-bearing areas. Infiltration of T cells in the peribulbar area is the pathogenesis of AA, which leads to disruption of the normal hair cycle[1]. AA can occur at any age and can affect either gender. The prevalence is approximately 0.001% of the population[2,3].

Management of AA involves both psychological support and medications, such as intralesional corticosteroids [ILCs], topical corticosteroids, anthralin, topical immunotherapy, and systemic corticosteroids[4]. ILC (usually triamcinolone acetonide) is a current treatment of choice for adult patients with limited disease[4-6]. Triamcinolone acetonide 2.5 to 5 mg/mL is used for lesions of the face and eyebrows, while concentration of 5 to 10 mg/mL is used for lesions of the scalp[3,6]. Results from a pilot study showed similar efficacy among 2.5, 5, and 10 mg/mL triamcinolone acetonide in treatment of limited, patchy AA. However, less corticosteroid-related side effects were observed in lesions treated with triamcinolone acetonide at 2.5 mg/mL[7].

To perform ILCs injection in AA, a 1 mL syringe is frequently used given its quantitative accuracy. A 21- or 22-gauge needle is used to draw up the triamcinolone acetonide solution, which is then diluted with saline or local anesthetic (e.g., lidocaine). After mixing the solution, the needle is changed to a smaller sized needle (27- or 30-gauge) for injection. Smaller needles are generally used because they produce less pain and

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provide more accuracy in injecting the desired amount of drug. The needle is inserted at an angle of 45 to 90 degrees to the lesion and triamcinolone acetonide 0.1 mL is then slowly injected into the mid-dermis layer. For large lesions, injections at intervals of 0.5 to 1 cm are needed to adequately medicate all AA-affected areas[5]. ILCs injection in AA should be repeated every four to six weeks.

Improper ILCs injection technique increases the probability of adverse corticosteroid-related side effects such as atrophy, telangiectasia, and hypopigmentation. Injection of corticosteroid into the subcutaneous layer may cause lipoatrophy and decrease therapeutic antiinflammation effect; whereas, injection into the upper dermis and/or epidermis may cause sloughing of the skin[8]. Concentration of medication is another sensitive factor. Use of high concentration of corticosteroid (triamcinolone acetonide 40 mg/mL) may lead to severe and potentially irreversible atrophic effects[8]. Another consideration is that ILCs injection produces pain and discomfort for the patient. The higher the corticosteroid concentration, the more discomfort the patient will experience. Complications and discomfort from ILCs injection can be reduced by using the lowest concentration and smallest quantity of the drug[9].

ILCs injection is considered as an uncomplicated procedure, however, correct injection technique is essential to prevent complications from corticosteroids. In Thailand, only 571 board-certified dermatologists are currently practicing, as compare to the estimated population of 67,000,000. Due to limited number of dermatologists, general practitioners have an important role in the management of dermatologic disease and dermatologist-related procedure including ILCs injection. To our knowledge, there is no study that has evaluated the level of clinical competence in performing this procedure. As such, the aim of the present study was to evaluate clinical competence in the procedure and identify the common pitfalls of ILCs injection technique in AA among Thai general practitioners.

Materials and Methods

One hundred twenty-seven general practitioners graduated from 14 different Thailand medical schools were included in the present study. All study participants attended the annual short courses in the practical dermatology for general practitioners organized by the Dermatological Society of Thailand [DST] in 2013 and 2014. This two-week short course provided intensive training in the essential dermatologic knowledge and workshop on ILCs skills. Before the workshop, a preliminary practical exam was conducted to determine each participant baseline knowledge and skill. Each participant was instructed to perform ILCs injection technique in AA by using an artificial skin model. The process of administering ILCs injection was divided into four categories (preparation technique, medication selection, equipment selection, and injection technique). The preparation parameters consisted of date of expired medication and mixing medication before used. The medication selection was concentration of selected steroids. The equipment selection was the size of syringes and needles. Injection techniques were composed of the depth, angle, and density of each injected site. Each of the four categories was scored by two experienced dermatologists, as followed, no pitfalls (three points), mild pitfalls (two points), moderate pitfalls (one point), and severe pitfalls (zero points). The definitions of grading categories were that no pitfalls implied, no complications, mild pitfalls suggested mild invisibly reversible complications, moderate pitfalls indicated moderate visibly reversible complications, and severe pitfalls were severe visibly irreversible complications. The medication and injection categories were weighted four and two times respectively due to their necessity in ILCs procedure. Differences in scoring between the two observing dermatologists were decided by consensus. The maximum achievable score was 24, while a score of less than 12 was considered to be a failing score. The cut-off point of 12 was similar from the routinely passing score of the Objective Structured Clinical Examination in medical students. After performing ILCs injection, a questionnaire was completed by each participant. The questionnaire was composed of four questions asking about side effects of corticosteroids, confidence in ILCs injection, history of training, and number of injected patients. The answers relating to side effects of corticosteroids were checked and scored as (one) correct and (zero) incorrect. The present study was approved by the Siriraj Institutional Review Board (SIRB).

Statistical analysis

All data analysis was performed using SPSS Statistics v.18 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were presented as mean and standard deviation or frequency and percentage. Associations among pitfalls of each grading component and comparison of pitfalls with several factors were

tested using Chi-square test for categorical variables and Student's t-test for continuous variables. Factors influencing fail outcome were examined using logistic regression. For all results, a two-sided *p*-value of 0.05 or less was considered statistically significant.

Results

Of the 127 general practitioners, 90 (70.9%) participants were female. The mean age was 28.32±4.69 years (range 23 to 47) but 50% of the participants were in the 26 to 30 age range. Mean work duration after medical school was 5.32±4.69 years. Thirty-nine (30.7%) physicians had previous knowledge of ILCs injection technique. Approximately 50% of participants reported having administered ILCs injection in AA patients; however, almost all (81.9%) physicians described no confidence in performing the procedure.

No participant was able to perform ILCs injection technique accurately in all of the four graded components (preparation technique, medication selection, equipment selection, and injection technique). The most common pitfalls among general practitioners was the concentration of triamcinolone acetonide used in ILCs procedure. Forty-two physicians (34.7%) used 40 mg/mL instead of 10 mg/mL triamcinolone acetonide for their ILCs procedure. Second common pitfall among general practitioners was incorrect injection technique (33.9%) including 1) inserting needle at too narrow an angle to the lesion, 2) inappropriate depth of injection, and 3) distance intervals between injection sites that were too short. Other observed pitfalls, rated as mild or moderate pitfalls, were incorrect preparation (not checking expiration date of medication and not mixing medication before use) (28.9%) and unsuitable equipment selection (19.8%).

The two observers agreed very well on the total score with intraclass correlation of 0.997 (95% CI 0.996 to 0.998) using a 2-way random effect model with absolute agreement definition. The difference in total score between the two observers had the mean of -0.092 (SD 0.52) and limits of agreement of -1.11 to 0.92. From the 127 participants, 45 received failed score (37.2%). The mean scores for the pass and fail group were 19.45±1.62 and 5.56±2.41, respectively. There was no variation in ILCs injection skill and knowledge among general practitioners by medical school (*p*-value 0.603). Most participants in the fail group (95.2%) selected wrong medication concentration (40 mg/mL triamcinolone acetonide) and 39% received a severe pitfall rating for their injection technique (Table 1). Univariable analysis revealed that less than 5-year experience seemed to relate to more failure. However, injection experience was not related to failure. No confidence in performing injection seemed to increase failure, but not statistically significant. Only two variables with univariable *p*-value less than 0.15 were entered into multiple logistic regression analysis. It showed that working less than five years seemed to increase failure (adjusted OR 1.88, *p*-value 0.123) (Table 2).

Table 1. Pitfalls of intralesional corticosteroid injections [ILCs] among passed and failed subjects

	Number (%)		*p*-value
	Pass (n = 76)	Fail (n = 45)	
Preparation			0.642
Correct	11 (15.3)	8 (18.6)	
Mild pitfall	61 (84.7)	35 (81.4)	
Medication			<0.001*
Correct	76 (100)	0 (0.0)	
Moderate pitfall	0 (0.0)	2 (4.8)	
Severe pitfall	0 (0.0)	40 (95.2)	
Equipment			0.001*
Correct	44 (60.3)	14 (36.8)	
Mild pitfall	28 (38.4)	18 (47.4)	
Moderate pitfall	1 (1.4)	4 (10.5)	
Severe pitfall	0 (0.0)	2 (5.3)	
Injection			<0.001*
Mild pitfall	38 (51.4)	10 (24.4)	
Moderate pitfall	35 (47.3)	15 (36.6)	
Severe pitfall	1 (1.4)	16 (39.0)	

* *p*-value ≤0.05 indicates statistical significance

The present study revealed another interesting result. Nearly 50% of physicians with previous knowledge of injection technique selected inappropriate medication for ILCs injection, as compared to the group that had no previous knowledge of injection technique (*p*-value 0.046). However, having previous knowledge of injection technique did not lead to more correct preparation, equipment, and injection (Table 3). Subjects with at least 5-year experience had higher percentage of correct medication, equipment, and injection (Table 4). Injection experience and injection confidence were not related to more correct preparation, medication, equipment, and injection (Table 5, 6).

Moreover, physicians with longer work duration after medical school also had a significantly higher level of confidence in administering ILCs injection (*p*-value 0.042) (Table 7). Physicians awareness of corticosteroid side effects were not different between physicians with previous injection technique knowledge compared with those without previous injection technique knowledge (*p*-value 0.499).

Table 2. Factors influencing fail outcome

	n	Fail (%)	Univariable analysis		Multivariable analysis	
			Crude OR (95% CI)	*p*-value	Adjusted OR (95% CI)	*p*-value
Work duration (years)						
<5	65	28 (43.1)	1.89 (0.86 to 4.17)	0.114	1.88 (0.84 to 4.19)	0.123
≥5	49	14 (28.6)	1		1	
Previous knowledge of injection technique						
Yes	39	19 (48.7)	1		1	
No	80	26 (32.5)	0.51 (0.23 to 1.11)	0.089	0.48 (0.21 to 1.09)	0.078
Injection experience						
Yes	60	23 (38.3)	1			
No	59	22 (37.3)	0.96 (0.46 to 2.01)	0.906	-	
Confidence in performing injection						
Yes	12	3 (25.0)	1			
No	104	40 (38.5)	1.88 (0.48 to 7.34)	0.367	-	

Table 3. Comparison of pitfalls between subjects with and without previous knowledge of injection technique

	Previous knowledge, n (%)		*p*-value[@]
	No (n = 80)	Yes (n = 39)	
Preparation			0.132
Correct	9 (12.2)	9 (23.1)	
Mild pitfall	65 (87.8)	30 (76.9)	
Medication			0.046*
Correct	54 (70.1)	20 (51.3)	
Moderate, severe pitfall	23 (29.9)	19 (48.7)	
Equipment			0.483
Correct	37 (49.3)	21 (61.8)	
Mild pitfall	34 (45.3)	10 (29.4)	
Moderate, severe pitfall	4 (5.3)	3 (8.8)	
Injection			0.478
Mild pitfall	33 (43.4)	13 (35.1)	
Moderate pitfall	32 (42.1)	18 (48.6)	

[@] Chi-square for linear-by-linear association

* *p*-value ≤0.05 indicates statistical significance

Table 4. Comparison of pitfalls between subjects with different work duration

	Work duration, n (%)		*p*-value[@]
	<5 (n = 65)	≥5 (n = 49)	
Preparation			0.304
Correct	8 (13.1)	10 (20.5)	
Mild pitfall	53 (86.9)	39 (79.5)	
Medication			0.069
Correct	37 (57.8)	35 (74.5)	
Moderate, severe pitfall	27 (42.2)	12 (25.5)	
Equipment			0.048*
Correct	28 (45.9)	28 (63.6)	
Mild pitfall	28 (45.9)	15 (34.1)	
Moderate, severe pitfall	5 (8.2)	1 (2.3)	
Injection			0.002*
Mild pitfall	19 (30.2)	25 (54.4)	
Moderate pitfall	31 (49.2)	19 (41.3)	
Severe pitfall	13 (20.6)	2 (4.3)	

[@] Chi-square for linear-by-linear association

* *p*-value ≤0.05 indicates statistical significance

Table 5. Comparison of pitfalls between subjects with and without injection experience

	Injection experience, n (%)		*p*-value[@]
	No (n = 59)	Yes (n = 60)	
Preparation			0.472
Correct	8 (13.6)	10 (18.5)	
Mild pitfall	51 (86.4)	30 (81.5)	
Medication			1.000
Correct	37 (63.8)	37 (63.8)	
Moderate, severe pitfall	21 (36.2)	21 (36.2)	
Equipment			0.804
Correct	28 (52.8)	30 (53.6)	
Mild pitfall	21 (39.6)	23 (41.1)	
Moderate, severe pitfall	4 (7.5)	3 (5.3)	
Injection			0.117
Mild pitfall	26 (44.1)	20 (37.0)	
Moderate pitfall	28 (47.4)	22 (40.8)	
Severe pitfall	5 (8.5)	12 (22.2)	

[@] Chi-square for linear-by-linear association

Table 6. Comparison of pitfalls between subjects with and without injection confidence

	Injection confidence, n (%)		*p*-value[@]
	No (n = 104)	Yes (n = 12)	
Preparation			0.964
Correct	16 (16.2)	2 (16.7)	
Mild pitfall	83 (83.8)	10 (83.3)	
Medication			0.534
Correct	64 (63.4)	9 (75.0)	
Moderate, severe pitfall	37 (36.6)	3 (25.0)	
Equipment			0.669
Correct	50 (52.6)	6 (54.5)	
Mild pitfall	39 (41.1)	5 (45.5)	
Moderate, severe pitfall	6 (6.3)	0 (0.0)	
Injection			0.752
Mild pitfall	42 (42.9)	4 (33.3)	
Moderate pitfall	40 (40.8)	8 (66.7)	
Severe pitfall	16 (16.3)	0 (0.0)	

[@] Chi-square for linear-by-linear association

Table 7. Correlation between work duration and injection experience and confidence in performing injection technique

	Work duration, n (%)			*p*-value
	<5 years	5 to 10 years	>10 years	
Injection experience				0.541
Yes	31 (47.0)	19 (52.8)	7 (53.8)	
No	35 (53.0)	17 (47.2)	6 (46.2)	
Confidence in performing injection technique				0.042*
Yes	5 (7.6)	3 (8.8)	4 (30.8)	
No	61 (92.4)	31 (91.2)	9 (69.2)	

* *p*-value ≤0.05 indicates statistical significance

Discussion

The limited number of dermatologists and inadequate supply of dermatologic services have been observed in several countries including United States[10] and Saudi Arabia[11]. Similarly, the imbalance proportion of practicing dermatologists and total population is also found in Thailand. Consequently, general practitioners became an important role in the management of dermatologic diseases and dermatologic interventions. ILCs injection is the primary procedure for the treatment of AA. This can be safely administered by general practitioners. However, the method of injection is the critical issue in the efficacy and development of complication of the injection.

Each medical school in Thailand has a different approach to how to train medical students to administer ILCs injections. According to limited hours for dermatologic training, most medical schools provide theoretical instruction, with only a small percentage providing practical clinical instruction. As a result, general practitioners can practice the procedure themselves or learn from other sources, which may not be competent or qualified. The evidence from our findings showed that no participant performed ILCs injection correctly in all of the four grading categories. Moreover, previous knowledge of injection technique failed to decrease the pitfalls of ILCs procedure in general practitioners.

The authors' study also found that inappropriate medication selection was the most common severe pitfalls among general practitioners. Almost half of the participants selected the incorrect medication concentration. Furthermore, they were physicians with previous knowledge of injection technique. The findings should be considered since injection with higher strength of corticosteroid will result in the development of permanent atrophy[8]. Incorrect injection technique was another common pitfall in ILCs procedure. The authors' findings showed that previous knowledge of injection technique did not decrease injection pitfalls.

The previous study from the United States reported limited curriculum hours for instruction in dermatology[12]. Moreover, most schools do not expect medical students to learn how to perform dermatologic procedures[13]. The present findings comparably reveal that ILCs injection instruction and practice in medical school are insufficient for general practitioners to perform correctly. Moreover, this inadequate training leads to overlook the common injection pitfalls. The authors believe that the situation could be found among general practitioners in other countries that had similar dermatologic curricula.

To increase physician's awareness and minimize errors of ILCs injection procedure, theoretical instruction along with sufficient practical training in medical school is required. The authors strongly recommend practicing ILCs injection using either artificial skin or real patients to maintain and improve ILCs injection technique skills. Proper concentration of corticosteroid being used for the treatment of AA should be emphasized. In addition, the injection technique regarding needle management, such as angle of the needle, depth of injection, and distance interval between injection sites should be topics of added focus.

This is the first study to indicate the potential pitfalls of ILCs injection procedure for the treatment of AA in the general practitioners in Thailand. However, several limitations may impact the study results. According to the different dermatologic curriculum in each medical school and in other countries, the results in the present study may not generalizable to all general practitioners. Participants recall bias, relative to work duration since graduation from medical school, was another limitation of the present study.

Conclusion

Inappropriate medication concentration and incorrect injection technique are the most common pitfalls that lead to side effects from corticosteroids. Sufficient training time and clinical experience in medical school are required to increase competency and decrease complications associated with this procedure. Practicing ILCs injection using either artificial skin or real patients at least two times per months is required to maintain and improve skills.

What is already known on this topic?

ILC injection is a common dermatologic procedure

for general practitioners in the treatment of various skin disease including AA. However, incorrect injection technique can lead to irreversible adverse effects.

What this study adds?

Many general practitioners performed ILCs incorrectly. The most common pitfall was inappropriate medical selection (triamcinolone acetonide 40 mg/mL), followed by incorrect injection technique. General practitioners with ILCs experiences could perform this procedure with more confidence.

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Potential conflicts of interest

The authors declare no conflict of interest.

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