The Laryngoscope

Clinical Implications of Intralesional Steroid Injections in the Management of Otohematoma

Sang-Yeon Lee, MD; Sun A Han, MD; Min Hyun Park, MD, PhD; Young Ho Kim, MD, PhD

Objectives/Hypothesis: To evaluate the long-term effects of intralesional steroid injections (ILSIs) in patients with otohematoma and to suggest the clinical implications, especially with regard to the duration of otohematoma.

Study Design: Retrospective analysis.

Methods: Fifty-six patients were enrolled and classified into short-term otohematoma (n = 30) and long-term otohematoma (n = 26) groups according to the period of time after auricular trauma. After the first ILSI, all patients underwent weekly examinations during the 21-day observational period to determine the treatment outcomes and were then followed up for reevaluation for a maximum of 36 months. We considered ILSIs to be ineffective if the otohematoma persisted after the third ILSI, and we opted to perform surgical treatment in such cases. In addition, we evaluated early recurrence, late recurrence, and ILSI-related complications.

Results: After up to three ILSIs, 29 out of 30 cases (96.7%) with short-term otohematoma and 20 out of 26 cases (76.9%) with long-standing otohematoma were treated without complications. Three patients with long-term otohematoma, however, experienced late recurrences at 4, 15, and 18 months, respectively. Seven patients who showed no response after ILSIs underwent surgical treatment. The duration of otohematoma (P = .043) and a higher initial aspirated fluid volume (P = .014) were shown to significantly increase the risk of treatment failure after ILSIs.

Conclusions: Multiple and immediate ILSIs in patients with otohematoma appear to be an effective treatment approach with no complications. Patients with short-term otohematoma showed better outcomes following ILSIs. The treatment approach may be optimized based on the duration and degree of otohematoma.

Key Words: Otohematoma, steroid injection, recurrence.

Level of Evidence: 4

***Laryngoscope*, 129:459–465, 2019**

INTRODUCTION

Otohematoma is a common otologic condition that results from trauma to the auricle, which can lead to separation of the anterior auricular perichondrium from the underlying adherent cartilage of the pinna.[1,2] This may cause tearing of the perichondrial blood vessels and subsequent hematoma formation. The subperichondrial hematoma then acts as a mechanical barrier between the cartilage and its perichondrial blood supply, stimulating fibrosis, granulation, and neocartilage formation.[2–4] If it is not managed promptly, otohematoma can result in complications such as perichondritis, perichondrium thickening, and "cauliflower ear."[5]

At present, although evidence to identify the most effective treatment for otohematoma is limited, incision and drainage methods in combination with the application of compression, especially when the otohematoma is large in diameter (>2 cm), are recommended due to their satisfactory results.[1–3,5–9] However, these invasive treatments may actually induce complications such as auricular thickening and perichondritis. Less invasive methods, such as needle aspiration, on the other hand, have shown a high rate of recurrence prior to the firm adherence of the perichondrium. Current literature suggests that the treatment depends on the size and the duration of the hematoma[5,6]; therefore, thorough understanding of the pathophysiology of subperichondrial hematoma and its behavior during the posttraumatic period is necessary for appropriate management.[3]

In some recent studies, intralesional steroid injections (ILSIs) following needle aspiration have shown favorable treatment outcomes in patients with otohematoma. However, widespread adoption of ILSIs in clinical practice for the treatment of otohematoma is limited by the lack of evidence of their therapeutic effectiveness, such as their ability to prevent early recurrence.[1,10–12] In addition, the follow-up periods after ILSIs in the previous studies were relatively short, ranging from 3 to 12 months; therefore, their long-term effectiveness has not been demonstrated.

In this study, we evaluated the long-term efficacy of ILSIs in patients with otohematoma. In addition, through an analysis of treatment outcomes and individual

From the Department of Otorhinolaryngology–Head and Neck Surgery, Seoul National University Boramae Medical Center, Seoul National University College of Medicine, Seoul, South Korea

Editor's Note: This Manuscript was received on March 1, 2018, revised on April 25, 2018, and accepted for publication on May 31, 2018.

This study was supported by a clinical research grant provided by Seoul National University Boramae Medical Center, Seoul, South Korea.

The authors have no other funding, financial relationships, or conflicts of interest to disclose.

Send correspondence to Young Ho Kim, MD, Department of Otolaryngology–Head and Neck Surgery, Seoul National University Boramae Medical Center, Seoul National University College of Medicine, 5 Gil 20, Boramae-Road, Dongjak-Gu, Seoul 156-707, South Korea. E-mail: yhkiment@gmail.com

DOI: 10.1002/lary.27404

characteristics, we also suggest the clinical implications, with an emphasis on otohematoma duration, in the management of otohematoma and the possible mechanism underlying the impact of ILSIs on otohematoma resolution.

MATERIALS AND METHODS

Patients

From January 2014 to December 2016, we retrospectively reviewed medical records from patients diagnosed with otohematoma who had received ILSIs at the Seoul National University Boramae Medical Center. We included cases with 1) a known interval between the initial traumatic event and the age of otohematoma, 2) ILSIs as the first-line treatment for the management of otohematoma, 3) a minimum follow-up period within 12 months from the date of treatment, and 4) absence of abnormalities in ear configuration. We assessed the patients' comorbidities and medication histories at first visit. Although four patients had diabetes mellitus, their blood glucose and glycated hemoglobin levels were well controlled.

Ultimately, 56 eligible patients were enrolled in this study. This study was approved by the institutional review boards of the Clinical Research Institute at Seoul National University Boramae Medical Center (IRB-03-2018-26). The patients were classified into the short-term otohematoma group (n = 30) if they showed clinical evidence of otohematoma for less than 2 weeks from the day of auricular trauma, or the long-standing otohematoma group (n = 26) if their otohematomas persisted for more than 2 weeks from the day of auricular trauma.

ISLI Procedure

All patients received an ILSI after needle aspiration by one of two surgeons (Y.H.K. and M.H.P). The otohematoma was completely aspirated with a 25-gauge needle and syringe, after which a volume of triamcinolone acetonide (40 mg/mL) equivalent to the aspirated fluid volume was injected into the empty subperichondrial space. When the aspiration volume exceeded 1.5 mL, the surgeon injected only 1.5 mL of triamcinolone acetonide to prevent infection and auricular deformity.[1] Auricular reshaping was done only via the steroid injection without any adjuvant therapy such as compression dressing. We present the procedure of ILSI in Figure 1.

After the first ILSI, all patients underwent weekly examinations during the observational period of 21 days to determine the treatment outcomes. During the observational period, the patients were administered up to three ILSIs depending on their response to the previous treatment. If the volume of aspiration at the second visit did not exceed 10% of that in the first aspiration, no further ILSIs were administered. In cases involving persistent otohematoma or an aspiration volume exceeding 10% of the volume at the previous visit, additional ILSIs were administered. Because previous studies have suggested that a blood collection located in the space between the skin and perichondrium is normally resorbed within 21 days,[2,13] we considered ILSIs to be ineffective if otohematoma persisted after the third ILSI, and we opted to perform surgical treatment in such cases.

Surgical Intervention

To evacuate the hematoma, under local anesthesia a small incision was made along the crease of the auricle, and the skin flap was elevated over the underlying hematoma with care to identify the precise location of the otohematoma paying special attention to the perichondrium and cartilage. We performed the open debridement of fibrocartilage and granulated tissue. In severe cases, we excised the newly formed fibrocartilagenous layer of auricular cartilage. As previously reported,[14] two Silastic sheets (0.02 inches thick; BioPlexus, Ventura, CA) were utilized for compression of the affected region. Each Silastic sheet covered the anterior and posterior surfaces of the hematoma and was anchored to the underlying auricle with mattress sutures using 5-0 nylon thread. All patients who underwent the surgical procedure were prescribed a 1-week course of oral antibiotics. All stitches and Silastic sheets were removed 1 week after the procedure.

Follow-up Protocol and Treatment Outcomes

According to the reevaluation manual of our clinic, the patients were instructed to present at 3, 6, 12, 24, and 36 months for reevaluation of recurrence. After 12 months reevaluation, the patients who were not able to present to the clinic in person were contacted via the telephone by the clinical research coordinator. The clinical research coordinator interviewed the patients regarding recurrence, infection, skin pigmentation, and auricular deformity via a phone call. In addition, regardless of the designated follow-up period, we further advised the patients to visit the clinic if the otohematoma recurred after the evaluation period. The treatment outcomes were evaluated after the follow-up period and were divided into four categories based on the physician's assessment: success, failure, early recurrence, and late recurrence. We defined success as complete resolution of the otohematoma during the follow-up period, failure if the patient

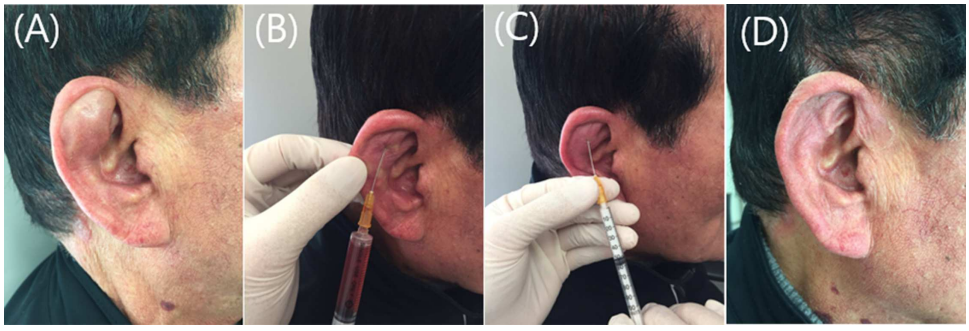

Fig. 1. The procedure of intralesional steroid injection for patients with otohematoma. (A) A 52-year-old male patient presenting with an otohematoma in the right ear. (B) Aspiration of otohematoma using a 25-gauge needle and syringe. (C) Injection of triamcinolone acetonide (40 mg/mL) into the empty subperichondrial space without a change of needle. (D) Auricular finding 1 week after intralesional steroid injection. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

underwent surgical treatment after a refractory response to three ILSIs, early recurrence if the hematoma reappeared during the 21-day observational period and necessitated additional ILSIs, and late recurrence if the hematoma reappeared unrelated to the date of auricular trauma and required additional injections after the observational period. In addition, we identified complications associated with ILSIs such as infection, changes in skin pigmentation, and auricular deformity.

Statistical Analysis

All data were analyzed using the Statistical Package for Social Sciences software version 22 (IBM, Armonk, NY). Treatment outcomes and demographic differences were analyzed using t tests, Mann-Whitney tests, overall exact χ^2 tests, and Fischer exact tests between the two groups, as appropriate. Partial correlation analysis was conducted to analyze the relationship between the initial aspirated fluid volume and treatment failure after ILSIs when the duration of otohematoma was controlled. In addition, binomial logistic regression analysis was performed to simultaneously assess the relative influence of ILSIs on treatment outcomes (success vs. failure) and associated variables (duration of otohematoma, size of otohematoma). P values < .05 were indicated statistical significance.

RESULTS

Demographic Characteristics

The patients' demographic and clinical characteristics are presented in Table I. All patients had otohematoma precipitated by blunt auricular trauma of various degrees. The mean age of the patients was 42.7 ± 17.1 years (range, 21–81 years), and 82.1% (n = 46) of the patients were male. Thirty-two patients (57.1%) presented with an otohematoma in their right ear, which was located in the helix (n = 9, 16.1%), antihelix (n = 12, 21.4%), scaphoid fossa (n = 21, 37.5%), or combined (n = 14, 25.0%). The mean follow-up period was 23.8 months (range, 12–36 months). There was no significant difference in age (41.5 ± 20.6 vs. 44.0 ± 12.2 years, P = .58), follow-up period (22.0 ± 8.9 vs. 25.9 ± 8.8 months, P = .11), sex (P = .73), side of otohematoma (P = .69), and location (P = .87) between the short-term and long-term otohematoma groups. The mean duration of otohematoma, as expected, was significantly different (5.2 ± 3.4 vs. 19.0 ± 6.7 days, P < .05) between the two groups (Table II). In this study, all patients were completely evaluated for the response to the steroid injection in the follow-up at 12 months. After the 12-month reevaluation, five patients who were not able to present to the clinic in person and were contacted via the telephone by the clinical research coordinator at 24 months or 36 months.

TABLE I.
Demographic Characteristics of the Subjects

Characteristic	Subjects With Otohematoma (n = 56)
Sex, no.	
Male	46
Female	10
Age, yr	
Mean	42.7 ± 17.1
Range	21–81
Laterality, no.	
Right	32
Left	24
Location, no.	
Helix	9
Antihelix	12
Scaphoid fossa	14
Combined	21
Etiology, no.	
Idiopathic	0
Blunt trauma	56
Follow-up, mo	
Mean	23.8 ± 10.2
Range	12–36

Treatment Outcomes: Early Recurrence

The longitudinal treatment responses to ILSIs following needle aspiration from hematoma of the patients are presented in Figure 2. Average fluid volumes at first aspiration in short- and long-term otohematoma were 0.88 ± 0.33 mL (range, 0.2–1.8 mL) and 1.02 ± 0.65 mL (range, 0.3–2.2 mL) (P = .28), respectively. During the 21-day observational period, 29 cases (96.7%) in the short-term group and 20 cases (76.9%) in the long-term group were treated with ILSIs, although there were eight (26.7%) and 20 (76.9%) early recurrences in each group, respectively. Twenty-two cases (77.3%) with short-term otohematoma and six cases (23.1%) with long-term otohematoma resolved with a single ILSI (P < .05). Among cases with persistent otohematomas, the average fluid volumes at the time of the second aspiration were 0.63 ± 0.21 mL and 0.74 ± 0.12 mL (P = .61) in short-term and long-term otohematoma, respectively; the average fluid volumes at the time of the third aspiration were 0.70 ± 0.45 mL and 0.76 ± 0.13 mL (P = .85) in short-term and long-term otohematoma, respectively. Among the eight and 20 early recurrence cases in the short-term and the long-standing otohematoma groups, respectively, five and nine cases resolved with a second ILSI (P = .012); two of the remaining three cases with short-term otohematoma and five of the remaining 11 cases with long-term otohematoma resolved with a third ILSI (P = .041).

Treatment Outcomes: Failure, Late Recurrence, and Complications

Seven nonresponders to the ILSIs (one with short-term otohematoma and six with long-standing otohematoma) underwent surgical treatment with open debridement. The aspirated fluid volumes of the nonresponders at their initial visit tended to be higher than those of ILSI responders, although the difference was not statistically significant (1.34 ± 0.57 vs. 0.89 ± 0.29 mL, respectively, P = .083). However, four of the seven nonresponders exhibited higher fluid aspiration volumes than the mean values of the nonresponders: 1.5 mL, 1.5 mL, 1.8 mL, and

TABLE II.
Comparison of Demographic Characteristics Among the Subjects With Different Otohematoma Duration

	Short-term Otohematoma, n = 30	Long-term Otohematoma, n = 26	*P* Value
Sex, no.			.73
Male	24	22	
Female	6	4	
Age, yr			.58
Mean	41.5 ± 20.6	44.0 ± 12.2	
Range	21–81	32–58	
Laterality			.69
Right	17	15	
Left	13	11	
Location			.87
Helix	5	4	
Antihelix	5	7	
Scaphoid fossa	8	6	
Combined	12	9	
Duration of otohematoma, d			<.01
Mean	5.2 ± 3.4	19.0 ± 6.7	
Range	1–13	14–32	
Total follow-up, mo			.11
Mean	22.0 ± 8.9	25.9 ± 8.8	
Range	12–36	12–36	

2.2 mL (Fig. 3). Notably, pathologic changes of the perichondrium or cartilage itself were seen in six patients who had otohematomas for more than 14 days. We demonstrated the seven patients' profiles who underwent surgery (Table III), including the location of otohematoma and pathologic findings. The patients with long-term otohematoma typically showed the pathologic findings including fibrocartilage formation, granulated tissue, and myxoid degeneration (Fig. 4), whereas only granulated tissue in the perichondrium was seen in the patient with short-term otohematoma.

There were no cases of late recurrence in the short-term otohematoma group, whereas three ILSI responders with long-term otohematomas exhibited recurrent hematomas at the same sites 4, 15, and 18 months after the observational period (Fig. 1). None of the patients experienced postprocedure complications such as secondary infection, auricular deformity, or perichondrial thickening throughout the follow-up period and up to 36 months after the treatments were administered. The treatment outcomes are presented in Table IV.

The use of surgical treatment in cases of treatment failure was significantly correlated with higher initial aspirated fluid volume (r = 0.451, P = .01). Furthermore, duration of otohematoma (P = .043, Exp[B] = 1.13) and higher initial aspirated fluid volume (P = .014, Exp[B] = 42.27) were shown to significantly increase the risk of treatment failure after ILSI.

DISCUSSION

In this study, we investigated the long-term effectiveness of ILSIs in patients with otohematomas, especially with regard to the duration of otohematoma. We demonstrated that 49 out of 56 patients (87.5%) with otohematoma were treated by ILSI without complications, suggesting that ILSIs may play a critical role in the management of otohematoma, possibly by inducing vasoconstriction and reducing extravasation in the empty space between the cartilage and perichondrium. In addition, we demonstrated the longitudinal therapeutic efficacy of ILSI, especially for management of otohematoma with a duration of less than 14 days, as evidenced by no recurrence up to 36 months. Pathologic changes of perichondrium seen in our six subjects, who carried otohematoma with duration more than 14 days,

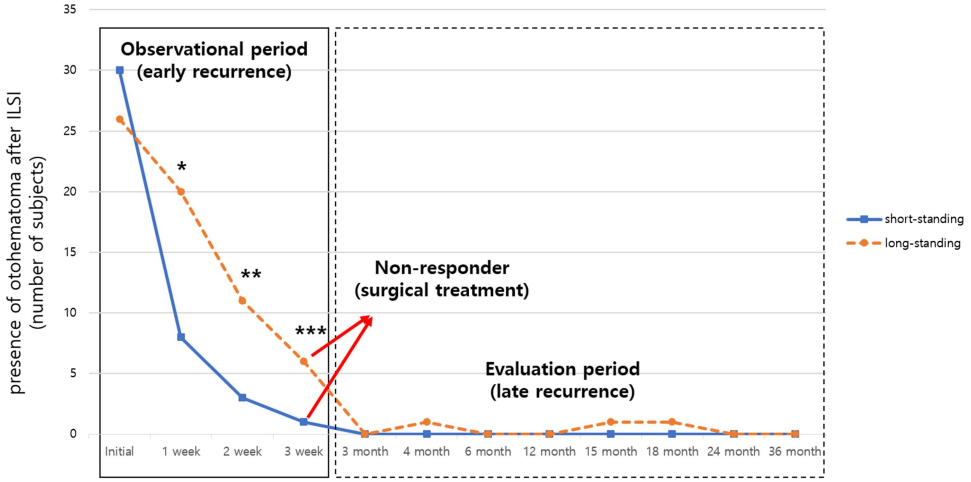

Fig. 2. The effects of intralesional steroid injections (ILSIs) in patients with otohematoma during the observational and evaluation periods. The treatment response by ILSI is significantly higher in the short-term group than in the long-term group during the observational period (*<.01, **.012, ***.041). Complete resolution of the otohematomas following up to three ILSIs was seen in 29 out of 30 cases of short-term otohematomas and 20 out of 26 cases of long-term otohematomas. Seven patients (nonresponders) underwent surgical treatment and demonstrated no recurrence after the operation. Three patients with long-term otohematoma developed late recurrences, whereas the short-term otohematoma group showed long-term remission without recurrence. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

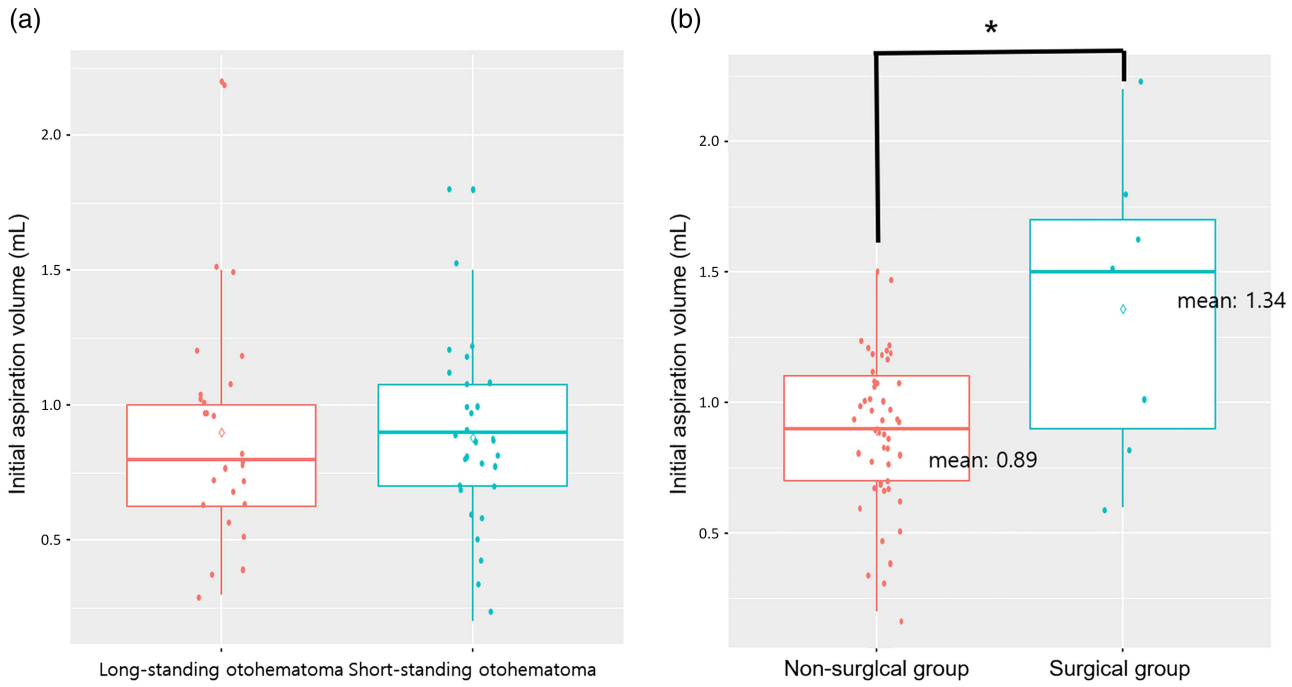

Fig. 3. (A) Initial aspiration volume based on the duration of otohematoma. Bar plot and jitter plots show the distribution and the mean of the initial aspiration volume. There was no significant difference in the initial aspiration volume between the short-term and long-term otohematoma groups. (B) Comparison of the initial aspiration volume between the surgical and the nonsurgical groups. The aspirated initial fluid volumes of the surgical group tended to be higher than those of the nonsurgical group (*P = .083). [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

and higher cavitary size of otohematoma might lead to refractory response to ILSI; accordingly, we suggest that long-term otohematoma from the onset requires continuing follow-up and surgical treatment in cases of recurrence.

Working Mechanisms and Clinical Implications of ILSI

Triamcinolone acetonide, a major component of the ILSI, is a synthetic corticosteroid commonly used to treat various skin conditions. It has been proposed that ILSIs exert anti-inflammatory and angiostatic effects by decreasing proinflammatory cytokine and helper T-cell levels. ILSIs may also reduce extravasation through arterial constriction,[15,16] precapillary sphincter narrowing, and coating of endothelial walls with leukocytes.[17] In addition, administration of high concentrations of triamcinolone acetonide, such as that as used in this study, can help regulate the granulated tissue containing excessive fibroblasts and blood vessels by inhibiting possibly transforming growth factor β1 expression and inducing apoptosis of fibroblasts.[18] These underlying properties of triamcinolone acetonide have been previously implicated in the management of otohematoma.[19] Despite the limited evidence, ILSI has demonstrated a high therapeutic efficacy in previous clinical studies.[1,10] One previous study demonstrated

TABLE III.
The Profiles of the Seven Patients With Otohematoma Who Underwent Surgery

Subject	Sex/Age, yr	Comorbidities	Duration, d	Initial Volume, mL	Location	Pathology
1	M/31	—	10	1.8	Perichondrium	Granulation
2	M/35	—	28	1.5	Perichondrium	Fibrosis, granulation
3	M/50	HTN	22	2.2	Perichondrium, cartilage	Fibrocartilage formation, granulated tissue, myxoid degeneration
4	M/55	—	16	1	Cartilage	Fibrocartilage formation
5	M/58	HTN r/o alcoholic hepatitis	23	1.5	Perichondrium, cartilage	Fibrocartilage formation, myxoid degeneration
6	M/55	—	20	0.8	Cartilage	Fibrocartilage formation
7	M/17	—	19	0.6	Cartilage	Fibrocartilage formation, granulated tissue

HTN = hypertension; M = male.

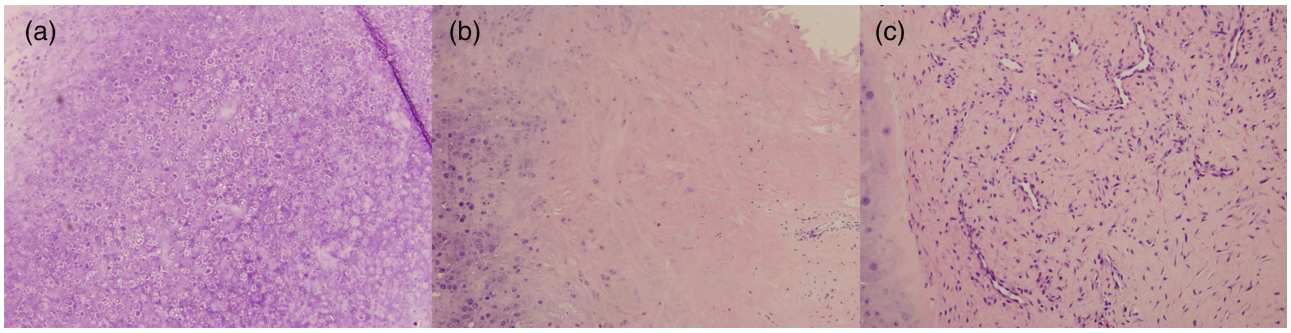

Fig. 4. Pathologic changes in the perichondrium seen in our representative patients who carried otohematoma with duration longer than 14 days. (A) Fibrocartilage formation. (B) Myxoid degeneration. (C) Granulation tissue. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

that 81% of patients recovered after a series of three ILSIs followed by aspiration.[10] Consistent with these reports, we also showed favorable treatment outcomes in 49 of 56 cases (87.5%) treated with three ILSIs with no complications.

Despite the high incidence of favorable treatment outcomes with ILSIs, the previous studies and the present study also observed refractory responses to ILSIs.[1,10] Currently, there is no comprehensive explanation for treatment failure and/or recurrence of otohematoma with ILSIs. When considering the current standard of practice that otohematomas with a duration more than 7 days warrant debridement of new perichondrial growth and remaining hematoma,[20] the duration of the hematoma seems to be an important factor determining the success in the treatment of otohematoma with ILSIs. A previous study by Im et al., which reported favorable treatment outcomes in all patients with multiple ILSIs, included patients who showed otohematoma development over less than 3 days.[1] In our study, although we showed complete resolution of otohematoma in 29 of 30 patients who had otohematoma over less than 14 days before the initial ILSI, ILSI did not sufficiently resolve otohematomas that had occurred more than 14 days before the initial ILSI. Six of the 26 patients with long-term otohematomas were classified as nonresponders to ILSIs and underwent the surgical procedure; moreover, three responders showed late recurrence of the hematoma at 4, 15, and 18 months after the observational period. Despite the relatively low number of late recurrence cases after 1 year, these incidences highlight the importance of long-term follow-up, especially for those in the long-term otohematoma group. Our findings suggest that early recognition of otohematoma and immediate medical treatment are crucial to improve the therapeutic efficacy of ILSI. In addition, the duration of the otohematoma should be considered when determining therapeutic approaches.

TABLE IV.
Treatment Outcomes According to Different Otohematoma Duration

	Short-term Otohematoma, n = 30	Long-term Otohematoma, n = 26	*P* Value
Observational period			
Early recurrences, no (%)	8 (26.7%)	20 (76.9%)	<.01
Success by first injection, no (%)	22 (73.3%)	6 (23.1%)	<.01
Success by second injection, no (%)	27 (90.0%)	15 (57.7%)	.012
Success by third injection, no (%)	29 (96.7%)	20 (76.9%)	.041
First aspiration volume, mL, mean (range)	0.87 ± 0.33 (0.2–1.8)	1.02 ± 0.65 (0.3–2.2)	.28
Treatment failure			
Surgical treatment, no (%)	1 (3.3%)	6 (23.1%)	.041
Follow-up period			
Late recurrences, no (%)	0 (0.0%)	3 (11.5%)	.094

Plausible Explanation Related to Treatment Failure and Recurrence

A previous study used histopathologic analysis to demonstrate that the severity of pathologic changes in the perichondrium, such as neo-fibrocartilage and organization, was correlated with the duration of otohematoma, and these changes were exacerbated when the hematoma settled over more than 14 days in the subperichondrial space.[3] Moreover, recurrent or persistent otohematomas were often characterized by multiloculated geometry within the auricular cartilage itself rather than the subperichondrial space.[2] Considering the marginal blood supply to the ear cartilage and the relatively short half-life of triamcinolone acetonide,[21,22] ILSI following needle aspiration may be ineffective to reverse pathologic changes in the perichondrium. Furthermore, a previous study using a rabbit model demonstrated that the presence of a pathologic remnant of the otohematoma after ILSI following aspiration indicated increased susceptibility to neocartilage development within the subperichondrial plane and, eventually over several weeks, cauliflower ear.[13] In these cases, a more invasive approach, such as a surgical procedure including complete debridement of the hematoma remnant, is recommended following a refractory response to ILSI, particularly with long-term otohematoma, to prevent recurrence and minimize otohematoma-associated complications.

Cavitary size, or the volume of fluid accumulated in the subperichondrial space, also has been reported to affect ILSI response.[23] The recurrence rate has been

reported to increase proportionally with increased cyst size.[23] The present study also showed that the mean initial aspiration volume among those who underwent surgical treatment tended to be higher than that among other patients (1.34 ± 0.57 mL vs. 0.89 ± 0.29 mL, $P = .083$). These findings imply that larger cavitary lesions are associated with higher susceptibility to inflammation and fibrosis, causing neocartilage formation and hampering the therapeutic efficacy of ILSI.

Limitations and Future Perspectives

To the best of our knowledge, this is the first study to assess the chronological efficacy of ILSIs in patients with otohematoma according to the duration and provide the clinical implications of ILSIs. However, there are some limitations of the present study that should be addressed. First, the patients showed several different responses after ILSIs, especially in recurrence. Although the discrepancies in responses to ILSIs and the recurrence within the same group might have been affected by the size or the interaction between the size and duration, our results cannot support this suggestion. Second, additional information on the characteristics of otohematomas in a large sample is necessary. Five patients did not present to the clinic for follow-up appointments and were contacted via the telephone. Although these patients account for only a small portion (8.9%), physical examinations by physicians are critical for thorough evaluation; therefore, a strategy for ensuring follow-up visits is necessary for future clinical studies. Third, although the present study evaluated the treatment outcomes of ILSIs along with the pathologic changes in those who underwent a surgical procedure, we also suggested that the histopathologic changes, such as neo-fibrocartilage, granulated tissue, and myxoid degeneration possibly led to the recurrence. Histopathologic evidence in a larger sample is necessary to address the causal effects of these pathologic changes on the recurrence of an otohematoma.

CONCLUSION

Multiple and immediate ILSIs in patients with otohematoma appear to be an effective treatment with no complications. We demonstrated the longitudinal therapeutic efficacy of ILSIs up to 36 months, especially for the management of otohematomas with durations less than 14 days. However, considering late recurrences beyond 1 year and the necessity of a surgical procedure in the management of otohematoma with durations longer than 14 days from the event and large cavitary size, long-term follow-up is essential. Moreover, considering the duration and degree of otohematomas may optimize the treatment approach.

BIBLIOGRAPHY

1. Im GJ, Chae SW, Choi J, Kim YS, Kim WJ, Jung HH. Intralesional steroid injection for the management of otohematoma. *Otolaryngol Head Neck Surg* 2008;139:115–119.
2. Ghanem T, Rasamny JK, Park SS. Rethinking auricular trauma. *Laryngoscope* 2005;115:1251–1255.
3. Lee BY, Han GC. Pathologic change of perichondrium on recurrent otohematoma. *Korean J Otolaryngol Head Neck Surg* 2003;46:198–201.
4. Mudry A, Pirsig W. Auricular hematoma and cauliflower deformation of the ear: from art to medicine. *Otol Neurotol* 2009;30:116–20.
5. Greywoode JD, Pribitkin EA, Krein H. Management of auricular hematoma and the cauliflower ear. *Facial Plast Surg* 2010;26:451–455.
6. Brickman K, Adams DZ, Akpunonu P, Adams SS, Zohn SF, Guinness M. Acute management of auricular hematoma: a novel approach and retrospective review. *Clin J Sport Med* 2013;23:321–323.
7. Kakarala K, Kieff DA. Bolsterless management for recurrent auricular hematomata. *Laryngoscope* 2012;122:1235–1237.
8. Khatatbeh WJ, Sbaihat AS. Treatment of auricular hematoma using dental rolls splints. *J R Nav Med Serv* 2011;18:22–25.
9. Kubota T, Ohta N, Fukase S, Kon Y, Aoyagi M. Treatment of auricular hematoma by OK-432. *Otolaryngol Head Neck Surg* 2010;142: 863–866.
10. Park JY, Shin SH, Kim KH, et al. Steroid Treatment of Otohematoma. *Korean J Otorhinolaryngol Head Neck Surg* 2000;43:155–158.
11. Miyamoto H, Oida M, Onuma S, Uchiyama M. Steroid injection therapy for pseudocyst of the auricle. *Acta Derm Venereol* 1994;74:140–142.
12. Kunachak S, Prakunhungsit S. A simple treatment for endochondral pseudocyst of the auricle. *J Otolaryngol* 1992;21:139–141.
13. Ohlsen L, Skoog T, Sohn SA. The pathogenesis of cauliflower ear. An experimental study in rabbits. *Scand J Plast Reconstr Surg* 1975;9:34–39.
14. Rah YC, Park MH. Use of Silastic sheets with mattress-fashion sutures for the treatment of auricular hematoma. *Laryngoscope* 2015;125:730–732.
15. Hashimoto I, Nakanishi H, Shono Y, Toda M, Tsuda H, Arase S. Angiostatic effects of corticosteroid on wound healing of the rabbit ear. *J Med Invest* 2002;49:61–66.
16. Griffith BH. The treatment of keloids with triamcinolone acetonide. *Plast Reconstr Surg* 1966;38:202–208.
17. Zweifach B, Shorr E, Black M. The influence of the adrenal cortex on behavior of terminal vascular bed. *Ann N Y Acad Sci* 1953;56:626–633.
18. On HR, Lee SH, Lee YS, Chang HS, Park C, Roh MR. Evaluating hypertrophic thyroidectomy scar outcomes after treatment with triamcinolone injections and copper bromide laser therapy. *Lasers Surg Med* 2015;47:479–484.
19. Mignogna M, Fedele S, Russo LL, Adamo D, Satriano R. Effectiveness of small-volume, intralesional, delayed-release triamcinolone injections in orofacial granulomatosis: a pilot study. *J Am Acad Dermatol* 2004;51: 265–268.
20. Riviello R, Brown N. Otolaryngologic procedures. In: *Roberts and Hedges' Clinical Procedures in Emergency Medicine*. 6th ed. Philadelphia, PA: Elsevier Saunders; 2014.
21. McLaughlin C. Composite ear grafts and their blood supply. *Br J Plast Surg* 1954;7:274–278.
22. Florini JR, Peets EA, Buyske DA. Plasma half-life, tissue distribution, and excretion of triamcinolone-H3. *J Pharmacol Exp Ther* 1961;131:287–293.
23. Miyamoto H, Okajima M, Takahashi I. Lactate dehydrogenase isozymes in and intralesional steroid injection therapy for pseudocyst of the auricle. *Int J Dermatol* 2001;40:380–384.