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Research Article

A Prospective Study on the Local Injection of Glucocorticoid and Gentamicin for Treating Ingrown Nails

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Background. Ingrown nails are a type of nonspecific inflammation of nail folds. Intralesional injection is a rarely reported nonsurgical therapy for ingrown nails. *Objective*. To observe the efficacy of treating ingrown nails with intralesional injection, and to evaluate at which stage ingrown nails are applicable for this therapy. *Methods*. Ingrown nails were randomly divided into treatment ($n = 87$) and control ($n = 37$) groups. The treatment group received local injections combined with basic nursing, whereas the control group was only treated with basic nursing. Patients were followed up at 1 week, 1 month, 3 months, and 6 months after the first treatment. *Results*. A statistically significant difference of the efficacy rates was observed between the two groups ($P < 0.05$). The overall satisfaction rate was 83.91% in the treatment group and 64.86% in the control group ($P = 0.019$). *Conclusion*. Intralesional injection is an effective therapy for ingrown nails, especially in the short term. This therapy is more applicable for Martinez-Nova stage I and IIA ingrown nails and can be used as a symptomatic treatment to relieve the acute inflammation of ingrown nails at stages IIB, III, and IV.

1. Introduction

Ingrown nails are chronic nonspecific inflammatory disorders, which occur when the periungual skin is punctured or traumatised by an adjacent nail plate [1]. This results in invasion by foreign bodies, which is sometimes followed by infection with signs of inflammation [2]. Clinical features of ingrown nails include redness, swelling, exudation, and granulation hyperplasia. Predisposing factors include anatomical abnormality of the phalanx, improper trimming of the nail plate, wearing constricting footwear, obesity, pincer nails, onychomycosis, and repetitive chronic trauma.

Different nonsurgical and surgical interventions for ingrown nails are available. Conservative interventions aim to relieve symptoms, prevent the worsening of ingrown nails, help cure the problem, and prevent relapse. Simple nonsurgical palliative measures include placing cotton wisps or dental floss under the ingrown lateral nail edge, using tape to pull the nail fold away from the nail plate, opening the curvature of the nail with a nail brace, and gutter splinting with or without the placement of an acrylic nail. Surgical treatments are mainly divided into nail plate avulsion with or without partial matrixectomy and nail fold excision, and include the Winograd technique, partial nail plate removal with matrix chemotherapy or matricectomy, and lateral nail fold excision. These approaches are superior to nonsurgical approaches for preventing relapse but are more traumatic [3–5]. Intralesional triamcinolone acetonide injections are commonly administered in patients with nail dystrophy. However, intralesional injection of triamcinolone acetonide for treating ingrown nails has not been proven effective and lacks parallel-controlled clinical studies with large samples [6]. In our clinical practice, we noticed that the local injection of glucocorticoids can inhibit nonspecific inflammation, and we have found that gentamicin is effective for treating secondary bacterial infections. Therefore, we

planned to observe the efficacy and adverse reactions of intralesional injection of glucocorticoids and gentamicin for the treatment of ingrown nails.

Martinez-Nova et al. proposed the stage of ingrown nails to help guide the therapy [7]; however, there is currently no standard therapy for managing ingrown nails at different stages. Generally, nonsurgical interventions are used for mild to moderate ingrown nails (stages I and II), whereas surgical approaches are used in moderate and severe cases (stage IIb, III, and IV). If intralesional injection therapy is effective, the symptoms of ingrown nails can be relieved. Here, we adopted the Martinez-Nova score to stage the severity of ingrown nails and applied the treatment with injection therapy and basic nursing to patients in each stage, targeting the best adaptation and providing data support for the standard treatment procedure of paronychia.

2. Materials and Methods

2.1. General Data. We conducted the study at the outpatient department of dermatology, the First Affiliated Hospital of Nanjing Medical University, between May 23, 2020, and March 17, 2021. The study included 103 patients (124 affected nails), comprising 87 patients in the treatment group and 37 patients in the control group. The patients in the treatment group received an injection combined with basic nursing therapy, whereas those in the control group were only treated with basic nursing. There were no significant differences in age, sex, paronychia stage, or degree of pain between the two groups.

The inclusion criteria were clinically diagnosed ingrown nail, no contraindication to medicine, no renal or hepatic dysfunction, age ≥14 years, and voluntary participation with good compliance.

The exclusion criteria were onychomycosis or severe nail deformity; serious systemic diseases, such as cardiac, renal, and hepatic dysfunction; contraindications to corticosteroids and aminoglycosides; allergy to related drugs; excessive sensitivity to pain; and pregnancy or lactation.

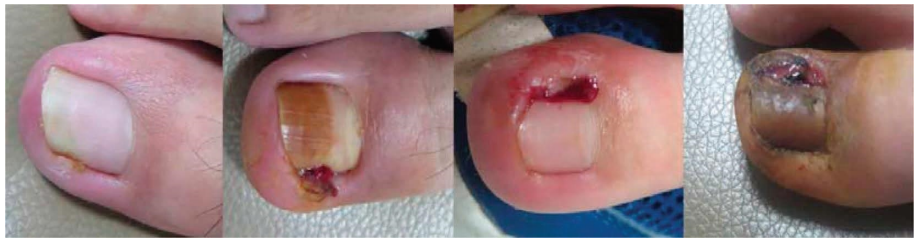
The severity of the ingrown nail was staged using the Martinez-Nova score, focusing on four aspects: erythema, swelling, exudation, and granulation hyperplasia [8]. The degree of pain was assessed based on patients' subjective feelings and was graded on a 4-point scale as follows: 0, no pain; 1, mild pain; 2, moderate pain; and 3, severe pain. A reduction in grade was defined as pain relief.

3. Methods

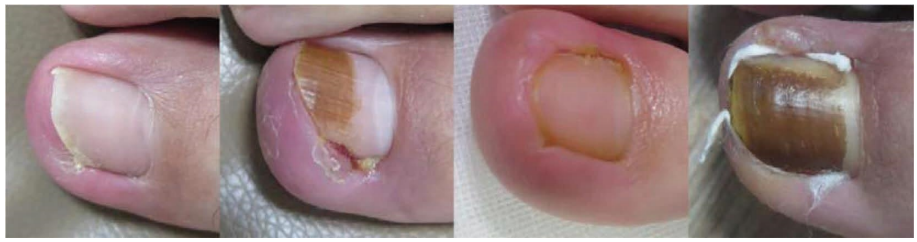
The control group received basic nursing care until the proximal lateral horn of the nail grew over the edge of the lateral nail fold. Daily nursing included soaking the affected foot in water at 43°C for 20–30 min, applying mupirocin ointment to the affected area every evening, placing cotton wisps between the lateral edge and nail fold of the affected nail, and keeping the distal edge of the cotton wisps under distal-lateral horn of the affected nail plate. Lifting the lateral nail plate out of the nail fold using cotton wisps may improve healing. In addition, the patient was advised about proper nail trimming and against performing strenuous activity. The treatment group was treated with injection therapy based on nursing. A 0.3 ml dose of compound betamethasone (betamethasone dipropionate: 5 mg/1 mL, betamethasone sodium phosphate: 2 mg/1 mL), 0.3 ml gentamicin (80 mg: 80, 000 U/2 ml), and 0.4 ml 2% lidocaine were mixed well. The unilateral nail fold was injected with 0.3 ml of the mixture. The basic nursing approach was the same as that used for the control group. The treatment group received injection therapy every week. Also, the sessions of injection were from one to four times. During the treatment phase, the patients were re-evaluated every week and their responses were assessed by clinical examination. Resolution was achieved when the redness, swelling, and exudation had disappeared, the granulation hyperplasia had completely/almost disappeared, and no pain was present. If resolution was achieved, the injection sessions would be ended and the follow-up visits would be scheduled at 1 week, 1 month, 3 months, and 6 months from the first injection. We continued the basic nursing with no injection and the follow-up visits were conducted as our study protocol, if there was no improvement after four successive injections. We considered the therapy ineffective if there was no improvement after four successive injections.

The follow-up visits of both groups were scheduled at 1 week, 1 month, 3 months, and 6 months from the first injection, and it included outpatient visits, photographs, and phone calls. The efficacy was accessed on 4-grade scale as follows: resolution was considered when the redness, swelling, and exudation had disappeared, the granulation hyperplasia had completely/almost disappeared, and no pain was present; marked improvement was considered when the redness, swelling, and exudation had almost disappeared, granulation hyperplasia was significantly improved, and the pain had subsided or disappeared; moderate improvement was considered when at least one of the following was improved and the pain had subsided or disappeared: redness, swelling, exudation, and granulation hyperplasia; and no change or even worse was considered when the redness, swelling, exudation, granulation hyperplasia, and pain were not improved or even worse than before. Relapse consisted of a sudden recrudescence of pain associated with oozing or inflammation of the lateral nail fold during the follow-up period. We considered resolution, significant improvement, and moderate improvement effective. Any adverse effects or complications were recorded and monitored at every visit, and all patients were assessed for relapse. Patient outcome satisfaction was evaluated at the final visit.

Statistical analyses were performed using SPSS 20.0. The chi-square test was used for categorical variables to compare the treatment outcomes of the two groups, and the logistic regression model was used to analyse the related factors affecting the prognosis of patients with ingrown nails. Statistical significance was set at $P < 0.05$.



(a)



(b)

Figure 1: Exudation, suppuration, and granulation hyperplasia were greatly improved after 1 injection. Before treatment (a): 1 week after injection (b).

4. Results

4.1. Clinical Efficacy Comparison between the Two Groups. The treatment group received an average of 2.42 injections, following which, 86.21% of the affected nails showed obvious pain relief. Meanwhile, redness, exudation, and granulation hyperplasia improved within 1 week after the first injection (Figure 1), with a significant difference compared to the control group ($P < 0.01$). The difference in efficacy rates between the two groups was statistically significant ($P < 0.05$) at 1 and 3 months after treatment. However, there was no significant difference in the efficacy rates between the two groups at 6 months ($P > 0.05$) (Table S1). The characteristic cases are shown in Figures 2 and 3.

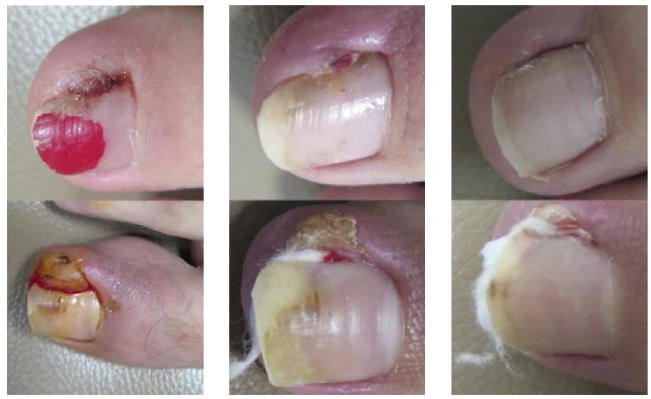
The effective rates of injection with nursing therapy for stage I, IIa, IIb, and III ingrown nails were 88.89%, 86.36%, 66.67%, and 66.67%, respectively. We performed univariate logistic analysis to confirm the influence of age, sex, injection, and stage of ingrown nails on the effective rate. Multivariate logistic regression analysis was conducted to eliminate confounding factors. The results showed that injection therapy was a reasonable approach in patients with mild to moderate ingrown toenails (stage I and stage IIa), and provided a marked improvement in the short term. The differences between the clinical efficacy of ingrown nails in stages I, II, and other stages were statistically significant ($P < 0.05$). The higher the stage of ingrown nail score, the less obvious the clinical effect ($P < 0.05$; odds ratio [OR], <1). Sex, age, and complications were not significantly associated with the outcomes ($P > 0.05$). Further details are shown in Tables S2 and S3.

4.2. Comparison of Side Effects, Recurrence, and Patient Satisfaction. Local side effects of the injections were observed in only three patients in the treatment group, including nail fold atrophy at the injection site in two patients and mild nail onycholysis in one patient. However, these signs gradually resolved and completely disappeared over time. No obvious adverse effects were observed in the control group. Six of the forty-eight (6.0%) cured cases in the treatment group relapsed. Among the six recurrent cases, four underwent surgery, one achieved great improvement after injection with basic nursing, and one patient received relief after basic nursing. Three of the fourteen (8.1%) cured cases relapsed in the control group, and they experienced clinical improvement after consistent basic nursing. The mean satisfaction of the treatment group and control group was 83.91% and 64.86%, respectively.

5. Discussion

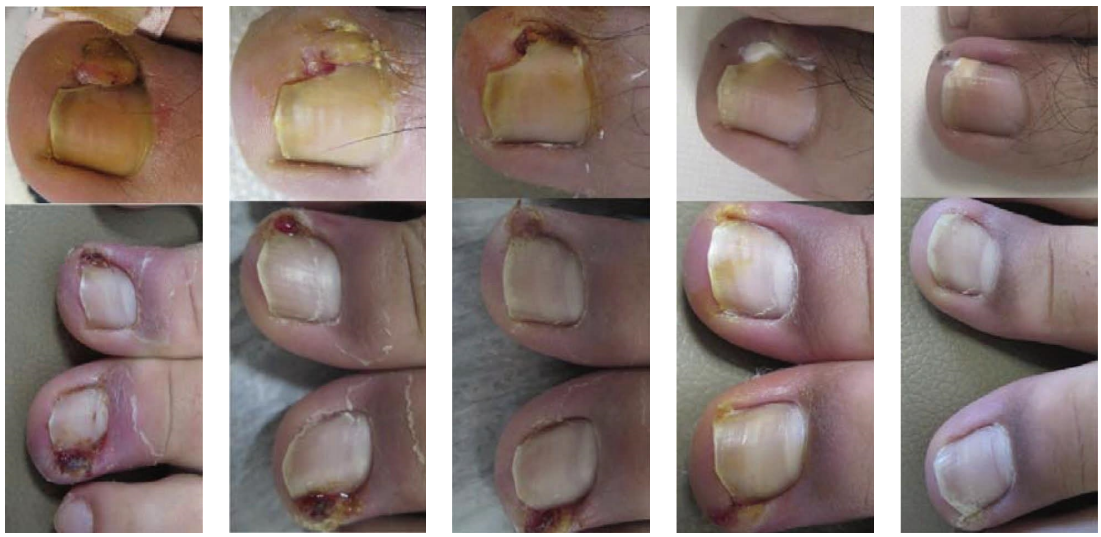
Ingrown nails are among the most common nail disorders, and greatly affect daily activities and cause extreme discomfort [9]. Ingrown nails occur when periungual skin is punctured or traumatised by one of the distal angles of the nail plate. This results in the inflammation by invasion of foreign bodies. If the side of the puncture suffers secondary bacterial infection, the inflammation of the affected side may get worse with local redness, swelling, pain, and granulation hyperplasia on the side of the puncture [10]. Although pain relief can be achieved using conservative approaches, most patients prefer surgery. However, compared to conservative therapy, surgery is more traumatic and may be accompanied by postoperative side effects.

Intralesional injection has a direct local effect, which is both simple and conservative. Low-solubility steroids can be slowly absorbed from the injection site to provide local depot therapy. Intralesional injection of steroid is mainly used to control noninfectious inflammatory responses, improve swelling, relieve pain, and inhabit granulation hyperplasia. Generally, the therapeutic dosage has no systemic side effects because of the small amount of local absorption.



(a) (b) (c)

Figure 2: Inflammation was largely relieved after injection therapy. Before treatment (a); 1 week period (b); 1 month period (c).



(a) (b) (c) (d) (e)

Figure 3: Signs and symptoms of ingrown nail before and after injection therapy. Before treatment (a); 1 week period (b); 2 week period (c); 1 month period (d); 3 month period (e).

Intralesional steroid injection is commonly performed for many skin diseases, such as keloids, hyperplastic scars, cystic acne, alopecia areata, localised scleroderma, discoid lupus erythematosus, and sarcoidosis [11–14]. However, there are no parallel-controlled clinical studies with large samples on the treatment of ingrown nails by intralesional injection of steroids, and no standard in injection quantity and frequency. Some researchers have administered intralesional injections of triamcinolone acetonide to treat ingrown nails. Four of the five patients were cured after a single injection, and the other one was cured after three injections (with an interval of 3 weeks). Those researchers followed all cases for up to a year and none of them relapsed. Although the sample size of the study was small, it suggested that intralesional injection for treating ingrown nails is effective and worthy of further study. We expanded the sample size and included a control group to increase the reliability of the results. Furthermore, we used betamethasone and gentamicin to control inflammation and infection and lidocaine to relieve pain. Chronic ingrown nails develop secondary bacterial infection with obvious exudation clinically. According to the literature, ingrown nails tend to have local infection [15]. Gentamicin works in two ways for treating ingrown nails. On one hand, gentamicin has antibacterial effect, against Gram-negative and Gram-positive bacteria [16]. On the other hand, gentamicin can prevent aggravation of bacterial infection after the intralesional injection of steroid. In clinical studies, we recognized that intralesional injection of steroid led to ulceration worsening when the local suppuration of the affected side was obvious. Thus, we chose to add gentamicin into the liquid to control infection. In addition, the mixture of gentamicin and normal saline is often used to

form intracavitary flushing solution, applied to skin grafting, bladder, marrow irrigation, and so on. The concentration of gentamicin we selected is obviously higher than that of the flushing solution. All patients reported that the approach was painful but tolerable.

The results showed that intralesional injection of betamethasone and gentamicin can control inflammation and quickly relieve pain at a safe dosage. Although pain relief and wound healing can be achieved using basic nursing for stage I or IIa ingrown nails, rapid improvement was achieved in combination with injection therapy. It was generally thought that intralesional injection can only relieve symptoms in moderate and severe cases (stage IIb, III, or IV ingrown nails). Our clinical trial showed that the adjuvant therapy approach allowed patients with moderate or severe ingrown nails to return to normal activities, with improved quality of life.

In this study, the efficacy rate of the treatment group was higher than that of the control group. There was a statistically significant difference between the rates of the two groups after 1 week, 1 month, and 3 months of treatment ($P < 0.05$). The long-term follow-up (>6 months of treatment) showed no obvious difference in the overall outcome of the injection ($P > 0.05$). A few patients relapsed, but most of them had a phalangeal deformity or a pincer nail. This indicated that intralesional injection could control inflammation and relieve pain quickly in the short term but was not suitable for radical therapy. Therefore, when ingrown nails are complicated by abnormal anatomy, such as pincer nails, phalangeal deformities, and/or severe focal inflammation and hyperplasia, surgical interventions may be the first choice.

In conclusion, intralesional injection with nursing can be implemented when ingrown nails are in stage I and stage IIa. Although some ingrown nails in stage I can be cured by basic nursing, injection therapy can rapidly improve the symptoms and shorten the treatment duration. For patients with stage IIb, III, or IV disease, local injection is mainly used to relieve the symptoms, with no advantage in long-term treatment outcomes. Thus, intralesional injection is considered a temporary method for the treatment of moderate or severe cases.

Data Availability

The datasets generated and/or analysed during this study are available from the corresponding author on reasonable request.

Ethical Approval

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of the First Affiliated Hospital of Nanjing Medical University (IRB-GL1-AF05; 2021-NT-32).

Consent

Informed consent was obtained from all patients involved in the study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Xiao-qing Wang and Jia-yi Jiang contributed equally to this work. X. W. and J. J. designed the study. M. L., Z. L., F. L., S. H., and H. S. W. collected the data. X. W. and J. J. analysed the results. X. W. and J. J. wrote the paper. X.W., J. J., M. L., Z. L., and D. W. discussed and revised the paper.

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Supplementary Materials

Table S1: comparison of clinical efficacy between the two groups in the follow-up period. Note: compared to the control group at 1 week, 1 month, and 3 months after treatment, $^{*}P < 0.05$, $^{**}P < 0.01$; and at 6 months after treatment, $^{\#}P > 0.05$. Table S2: univariate logistic regression analysis affecting the prognosis of patients with ingrown nails. Note: compared to ingrown nails in stage I, $^{*}P < 0.05$ in stage IIb and III; the number of cases was small, so the analysis was meaningless. Table S3: multivariate logistic regression analysis affecting the prognosis of patients with ingrown nail. Note: the number of cases was small, so the analysis was meaningless. (*Supplementary Materials*)

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