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CASE SERIES

# Fire Needle Combined Topical Mupirocin for the Treatment of Simple Skin Abscesses in Pediatric Patients: A Case Series

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**Background:** Skin abscesses are a common skin condition usually caused by bacterial infections and their incidence is increasing in children. Its current management strategy is still mainly incision and drainage, sometimes with antibiotics. In pediatric patients, surgical incision and drainage of skin abscesses is challenging compared to in adults because of their specific age and psychological characteristics and high aesthetic requirements. Therefore, it is important to seek better treatment options.

**Patients and methods:** We reported 17 cases of skin abscesses in pediatric patients aged 1 to 9 years. Ten cases had lesions on the face and neck and 7 cases on the trunk and limbs. They all received treatment based on fire needle combined with topical mupirocin.

**Results:** The lesions of all 17 pediatric patients healed within 4 to 14 days, with a median time of 6 days, and all achieved satisfactory results with no scarring left behind. No adverse events were observed in all patients, and no recurrence occurred within 4 weeks.

**Conclusion:** For skin abscesses in pediatric patients, early application of a combination therapy based on fire needle is convenient, aesthetic, economical, safe and clinically important as an alternative to incision and drainage, and deserves further clinical promotion.

**Keywords:** fire needle combined therapy, simple skin abscesses, pediatric patients, mupirocin

## Introduction

Skin abscesses are a common skin disease in which pus accumulates in the dermis or subcutaneous tissue, usually caused by a bacterial infection, and their incidence is increasing in children.[1–3] Clinical signs of skin abscesses include erythema, swelling, pain, fluctuating lumps and pus oozing.[4] Skin abscesses are usually 1–3 cm long in diameter and can sometimes be larger. Single abscesses up to 5 cm in diameter (3 cm in patients aged 6–11 months, 4 cm in patients aged 1–8 years) are classified as simple skin abscesses.[5,6] The incision and drainage procedure is the main treatment option for skin abscesses, and antibiotics such as clindamycin and mupirocin have been shown to improve outcomes.[7,8] However, antibiotics alone can sometimes be ineffective due to the worldwide spread of antimicrobial resistance, and the disease continues to progress.[9,10] For skin abscesses that do not drain independently, the mainstay of treatment remains incision and drainage (I&D).[6] But incision and drainage can be relatively more challenging for pediatric patients. Children are in a critical period of growth and psychological development and are extremely demanding in aesthetics,[11] they are more reluctant to undergo incision and drainage procedures than adults.[12] Surgery is particularly problematic for pediatric patients who may require sedation, and post-operative care is more difficult than for adults.[13] Furthermore, the surgical incision and stuffing with gauze is extremely painful for children and the tamponade may be removed, making a second operation more likely.[14] Although Ladde JG, Rencher L et al advocated the use of the new minimally invasive LOOP technique as an alternative to standard incision and drainage and tamponade treatment, it still carried some risk of leaving a surgical scar and requiring a second incision if treatment fails.[15,16] According to Ladde JG, the treatment failure rate of the I&D and LOOP methods in treating skin abscesses of children was 16.5% and 3.9% respectively.[15] Rencher L reported that the treatment failure rates of LOOP and I&D were 7.3% and 7.5%, with the parental dissatisfaction rates of on day 14 after surgery 13.9% and 11.8% respectively.[16] Therefore, searching for better treatments is the key to solving such problems.

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Fire needle is one of the three main types of acupuncture in Chinese medicine and has a history of thousands of years. According to the literature reports, fire needle therapy is widely used in surgery, gynecology, orthopedics and internal medicine.[17] It is also considered an effective treatment for skin diseases such as psoriasis, vitiligo, and acne.[18–20] According to the literature review, fire needle therapy can accelerate local blood circulation and reduce pathological changes in local tissue such as edema, congestion, and exudation.[21] Furthermore, the fire needle directly stimulates the lesion and raises the skin temperature around the lesion, thus accelerating metabolism and promoting the repair of damaged tissue.[22] Clinical trials and animal studies have shown that the specific mechanisms of fire needle therapy include the following aspects: regulating the secretion of cytokines such as reducing IL-6, TNF-α, IL-1β and increasing IL-10, promoting the release of growth factors such as VEGF, and regulating the proportion of immune cells such as increasing the number of CD4+ T cells and type 2 helper T cells.[20,23,24] In recent years, fire needle therapy has also been reported to treat bacterial infectious skin diseases, including perifolliculitis capitis abscedens et suffodiens, carbuncle of neck.[25,26] But there is little evidence from clinical studies on treating skin abscesses with fire needle. Most of the patients in the previous clinical studies on fire needle therapy were adults, and the clinical efficacy of fire needle in the treatment of children with skin abscesses is still unclear.

In this paper, we report our experience in treating 17 cases of pediatric patients with skin abscesses successfully by using fire needle combined therapy. It avoided further disease progression, surgical incision and drainage, and brought about satisfactory clinical effect and fantastic cosmetic results.

# Methods

The study was conducted in accordance with the principles of the Declaration of Helsinki and Good Clinical Practice Guidelines. Ethical approval has been confirmed by the Research Ethics Committee of the Second Hospital of Shandong University (No. KYLL-2023LW010). We confirmed that all guardians of the pediatric patients gave informed consent, signed the informed consent form and agreed to be published in this study.

## Inclusion Criteria

We included children aged 1 to 12 years diagnosed with uncomplicated simple skin abscesses at the Second Hospital of Shandong University with two or more of the following signs or symptoms for at least 24 hours: erythema, swelling or hard nodules, localized fever, purulent drainage, pain or pressure to touch; refusal of incision and drainage or contra-indication to incision and drainage.

## Exclusion Criteria

This included superficial skin infections, multiple abscesses, abscesses < 1cm or > 5cm, history of dizziness from acupuncture, coagulation disorders, liver and kidney disease and other disorders that possibly affect the results.

## Treatment Options

The lesion was routinely disinfected with iodophor and prepared for fire needle treatment. A disposable sterile stainless-steel needle (0.30 × 25 mm, China Wujiang Yunlong Medical Instrument Co Ltd) was selected. (Figure 1A) The lower part of the needle was heated with an alcohol lamp until the tip and front burned red. (Figure 1B) The needle was then rapidly and accurately inserted into the skin abscess lesion (approximately at a depth of the skin abscess capsule wall) at a 90° angle for about 0.5 s and then rapidly removed. We selected the appropriate number of needles during the treatment according to the patient's tolerance. The distance between needles on the lesion was about 0.5 cm. After puncturing the skin with the fire needle, the blood and pus was gently squeezed and cleaned with a cotton swab. During the treatment, for skin lesions on the face, especially on the upper lip and the dangerous triangle of the nose, the pus should be squeezed gently so that it flows out as naturally as possible to avoid the infection spreading caused by forced extrusion and discharge of pus. Finally, using a sterile cotton swab, we applied a 0.5 mm thick layer of mupirocin ointment to the affected area. After treatment, patients were asked to apply the same thickness of mupirocin ointment to the lesion twice daily. The lesion was not to be exposed to water or skin care products within 24 hours.

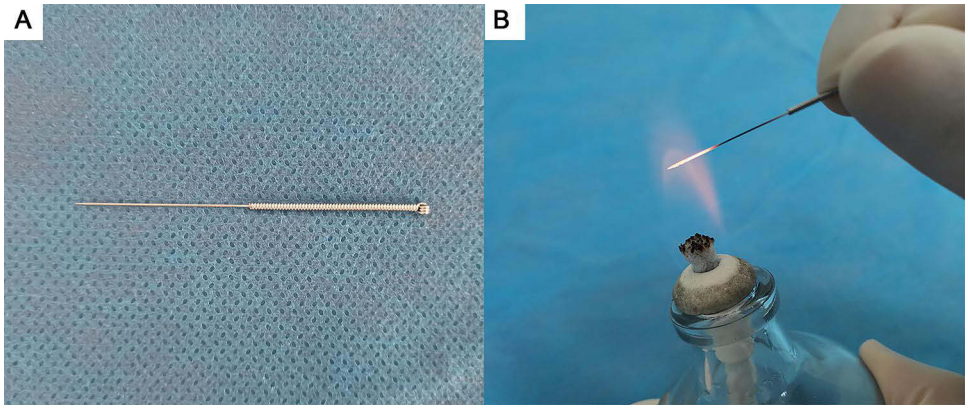


**Figure 1** Needle used in fire needle therapy in this study (**A**). Fire needle therapy (**B**).

## Observation Indicators

### Pain Level

The pain level was assessed using the Face, Legs, Activity, Cry, and Consolability (FLACC), with higher values indicating greater pain.[27,28] 1 to 3 were classified as mild pain, 4 to 6 as moderate pain and 7 to 10 as severe pain. The scores were 0, 1, 2 and 3 on a scale of no, mild, moderate and severe pain.

### Skin Lesion Level

Erythema or mild pigmentation, nodules, pustules and purulent discharge are scored 0, 1, 2 and 3 in that order.

### Efficacy Index and Efficacy Rating

Total score = pain level score + skin lesion level score. The Efficacy Index is calculated based on the total score before and after 7 days of treatment [(total score before treatment - total score after 7 days of treatment)/total score before treatment × 100%]. There were four levels of efficacy: complete remission (CR): Efficacy Index of 100%; significant remission (SR): 60% ≤ Efficacy Index ≤ 99%; partial remission (PR): 30% ≤ Efficacy Index ≤ 59%; no remission (NR): Efficacy Index < 30% or worsening of symptoms (Table 1).

### Basic Healing Time

Basic healing meant that the pain and the redness, nodules and pustules of the lesions had subsided, there was no flow of pus or exudate and only slight erythema or pigmentation of the skin remained. "Days" were used as the unit of measurement for basic healing time.

### Adverse Reactions

Patients were observed for adverse reactions such as scarring, poor mobility and infection during the treatment.

## Data Collection

Demographic data and clinical information were recorded. For all patients, images of skin lesions in normal ambient light were obtained before the start of treatment and during each treatment and follow-up, and the above observations were

**Table 1** Quantitative Criteria for Grading of Disease

| Skin Lesion | | Pain Degree | | Therapeutic Effect Evaluation | | |
|---|---|---|---|---|---|---|
| **Manifestation** | **Scale** | **FLACC Score** | **Scale** | **Efficacy Index** | **Therapeutic Effect** | **Abbreviation** |
| Erythema or mild pigmentation | 0 | 0 | 0 | 100% | Complete remission | CR |
| Tubercle | 1 | 1 ~ 3 | 1 | 60% ~ 99% | Significant remission | SR |
| Pustule | 2 | 4 ~ 6 | 2 | 30% ~ 59% | Partial remission | PR |
| Purulent discharge | 3 | 7 ~ 10 | 3 | <30% | No remission | NR |

recorded. The clinical characteristics of all cases were analyzed. The data collected were subjected to descriptive statistics using SPSS 25.0 software.

The follow-up period was 3 days, 1 week, 2 weeks and 4 weeks after the initial fire needle treatment. Follow-up was terminated when recurrence was observed.

## Results

A total of 17 pediatric patients, 10 females and 7 males, aged 1 to 9 years, were included in this study. The duration of the disease ranged from 3 to 12 days, with a median duration of 6 days. Lesions were located on the face in 9 patients, on the neck in 1 patient, on the limbs in 4 patients, and on the trunk in 3 patients (Table 2). All the above patients received the characteristic Chinese medicine treatment of fire needle combined with topical mupirocin (twice a day until basic healing). After receiving fire needle combined therapy, 11 cases achieved complete remission (CR) with an efficacy index of 100% at 1 week after treatment; 6 cases achieved significant remission (SR) with an efficacy index of 60% - 99% at 1 week after treatment and 100% within 2 weeks after treatment. (Table 3) Before treatment, the median Skin Lesion Scale and Pain Degree Scale of patients were both 2, which decreased to 0 after treatment. The degrees of skin lesion and pain were significantly reduced in all patients after treatment ($P<0.001$), and the overall efficacy index after seven days of treatment was 100%. The basic healing time was as fast as 4 days and as slow as 14 days, with a median of 7 days. (Table 4 and Table 5) Representative images are shown in Figures 2 and 3. At the follow-up of 3 days, 1 week, 2 weeks and 4 weeks after the treatment, there was no scar growth or other cosmetic problems, which did not affect the aesthetics; simultaneously, the muscles moved freely without nerve damage. All patients had no recurrence within 4 weeks of treatment.

All treatments were well tolerated. The pain caused by fire needle was mild to moderate and tolerable, and subsided quickly after the treatment. No other adverse effects such as infection or scarring were found in this study.

## Discussion

We reported 17 cases of simple skin abscesses in children who used fire needle combined therapy. The lesions of 10 patients were located on the face and neck, and the other 7 cases were located in important functional areas of the trunk and extremities. After 7 days of treatment with fire needle combined therapy, all patients' pain degrees were reduced to 0, and 65% of patients had only erythema or mild pigmentation left in their skin lesions. The overall treatment efficiency was 100%, with 65% of patients achieving complete remission on the Efficacy Index. Overall, all patients achieved

**Table 2** Demographic and Clinical Characteristics of Patients

| No. | Sex | Age (Year) | Duration (Day) | Site of Lesion | Size of Lesion (cm) |
|---|---|---|---|---|---|
| 1 | F | 3 | 6 | Cheek | 2.5 × 2.5 |
| 2 | M | 9 | 6 | Cheek | 1.0 × 0.8 |
| 3 | M | 7 | 10 | Nasal root | 2.5 × 2.5 |
| 4 | M | 5 | 12 | Nasal root | 3.0 × 1.5 |
| 5 | M | 2 | 6 | Frontal face | 2.0 × 2.0 |
| 6 | F | 8 | 6 | Zygomatic and periorbital | 1.8 × 1.5 |
| 7 | F | 2 | 12 | Tempus | 2.8 × 2.2 |
| 8 | M | 8 | 7 | Inner corner of the eye | 2.0 × 1.0 |
| 9 | F | 7 | 7 | Nasal root | 1.5 × 1.0 |
| 10 | M | 2 | 5 | Neck | 2.5 × 1.5 |
| 11 | F | 2 | 3 | Thigh | 1.5 × 1.5 |
| 12 | M | 1 | 3 | Arm | 2.8 × 1.3 |
| 13 | F | 1 | 6 | Buttock | 1.3 × 1.3 |
| 14 | F | 5 | 4 | Chest | 1.5 × 1.5 |
| 15 | F | 1 | 7 | Chest | 1.3 × 1.0 |
| 16 | F | 8 | 5 | Thigh | 2.5 × 2.5 |
| 17 | F | 6 | 3 | Thigh | 2.0 × 1.5 |

**Table 3** Efficacy and Follow-Up of Patients

| No. | Before Treatment | | 3 Days After Treatment | | 7 Days After Treatment | | Efficacy Index (%) | Therapeutic Effect | Basic Healing Time (Day) | Number of Fire Needle Therapy |
|---|---|---|---|---|---|---|---|---|---|---|
| | Skin Lesion | Pain Degree | Skin Lesion | Pain Degree | Skin Lesion | Pain Degree | | | | |
| 1 | 2 | 2 | 1 | 1 | 0 | 0 | 100 | CR | 6 | 1 |
| 2 | 2 | 2 | 2 | 1 | 0 | 0 | 100 | CR | 7 | 1 |
| 3[a] | 2 | 2 | 1 | 1 | 0 | 0 | 100 | CR | 7 | 2 |
| 4[a] | 2 | 2 | 2 | 1 | 1 | 0 | 75 | SR | 14 | 2 |
| 5 | 2 | 3 | 2 | 1 | 1 | 0 | 80 | SR | 8 | 1 |
| 6 | 2 | 2 | 2 | 0 | 0 | 0 | 100 | CR | 6 | 1 |
| 7[b] | 3 | 2 | 2 | 1 | 1 | 0 | 80 | SR | 12 | 3 |
| 8[a] | 3 | 3 | 2 | 1 | 1 | 0 | 83 | SR | 9 | 2 |
| 9[a] | 2 | 2 | 2 | 1 | 1 | 0 | 75 | SR | 12 | 2 |
| 10 | 3 | 2 | 2 | 1 | 0 | 0 | 100 | CR | 7 | 1 |
| 11 | 2 | 2 | 1 | 0 | 0 | 0 | 100 | CR | 4 | 1 |
| 12[a] | 2 | 2 | 1 | 0 | 0 | 0 | 100 | CR | 5 | 2 |
| 13 | 2 | 2 | 2 | 1 | 0 | 0 | 100 | CR | 6 | 1 |
| 14 | 2 | 1 | 2 | 1 | 0 | 0 | 100 | CR | 7 | 1 |
| 15 | 2 | 2 | 1 | 0 | 0 | 0 | 100 | CR | 5 | 1 |
| 16 | 2 | 2 | 2 | 1 | 1 | 0 | 75 | SR | 8 | 1 |
| 17[a] | 2 | 2 | 1 | 0 | 0 | 0 | 100 | CR | 4 | 2 |

**Notes**: Skin Lesion Scale: Erythema or mild pigmentation, nodules, pustules and purulent discharge are scored 0, 1, 2 and 3 in that order. Pain Degree Scale: The pain level was assessed using the Face, Legs, Activity, Cry, and Consolability (FLACC). 1 to 3 were classified as mild pain, 4 to 6 as moderate pain and 7 to 10 as severe pain. The scores were 0, 1, 2 and 3 on a scale of no, mild, moderate and severe pain. Efficacy Index and efficacy rating: Total score = pain level score + skin lesion level score. The Efficacy Index is calculated based on the total score before and after 7 days of treatment [(total score before treatment - total score after 7 days of treatment)/total score before treatment × 100%]. There were four levels of efficacy: complete remission (CR): Efficacy Index of 100%; significant remission (SR): 60% ≤ Efficacy Index ≤ 99%; partial remission (PR): 30% ≤ Efficacy Index ≤ 59%; no remission (NR): Efficacy Index < 30% or worsening of symptoms. [a]Received the second treatment on the 3rd day after the initial fire needle therapy. [b]Received the second and third treatments on the 3rd and 7th days after the initial fire needle therapy.

**Table 4** Summary of 17 Cases of Simple Skin Abscesses in Pediatric Patients

| Characteristics | Results |
|---|---|
| Number of patients | 17 |
| Gender, n (%) | |
| Male | 7 (41) |
| Female | 10 (59) |
| Age, years | 4.5 ± 2.9 |
| Duration, days | 6 (4.5, 7.0) |
| Distribution of skin lesions, n (%) | |
| Face and neck | 10 (59) |
| Trunk and limbs | 7 (41) |
| Therapeutic effect after 7 days of treatment, n (%) | |
| Complete remission, CR | 11 (65) |
| Significant remission, SR | 6 (35) |
| Partial remission, PR | 0 (0) |
| No remission, NR | 0 (0) |
| Efficacy Index after 7 days of treatment, % | 100 (80, 100) |
| Basic healing time, days | 7 (5.5, 8.5) |
| Times of fire needle therapy, n (%) | |
| 1 | 10 (59) |
| 2 | 6 (35) |
| 3 | 1 (6) |

**Table 5** Comparison of Skin Lesion and Pain Degree Before and After Treatment

| | Before Treatment | After 7 Days of Treatment | Difference | Z Value | P value |
|---|---|---|---|---|---|
| **Skin Lesion Scale**, M (P25, P75) | 2 (2.0, 2.0) | 0 (0.0, 1.0) | 2 (1.5, 2.0) | 3.782 | <0.001 |
| **Pain Degree Scale**, M (P25, P75) | 2 (2.0, 2.0) | 0 (0.0, 0.0) | 2 (2.0, 2.0) | 3.877 | <0.001 |

satisfactory clinical and cosmetic effects with rapid pain reduction and significant reduction of redness and swelling after treatment.

Currently, topical antibiotics are used in the treatment of skin abscesses in addition to the main incision and drainage therapy, but antibiotic use alone is sometimes ineffective due to bacterial resistance and skin barriers to the drug.[9,10] In this case series, all patients treated with fire needle combined with topical medication achieved satisfactory clinical outcomes. The high temperature of fire needle can kill pathogenic microorganisms and strengthen the antibacterial and anti-inflammatory effects. At the same time, the tiny holes left by the fire needles can weaken the skin barrier against the penetration of topical drugs, facilitate the transdermal absorption of antibiotic ointments and help to reduce antibiotic resistance.[29] Liu Z et al reported the successful treatment of three cases of carbuncle on the neck in adult patients using a therapy based on fire needle combined with antibiotics. Early and timely treatment with fire needle combined therapy

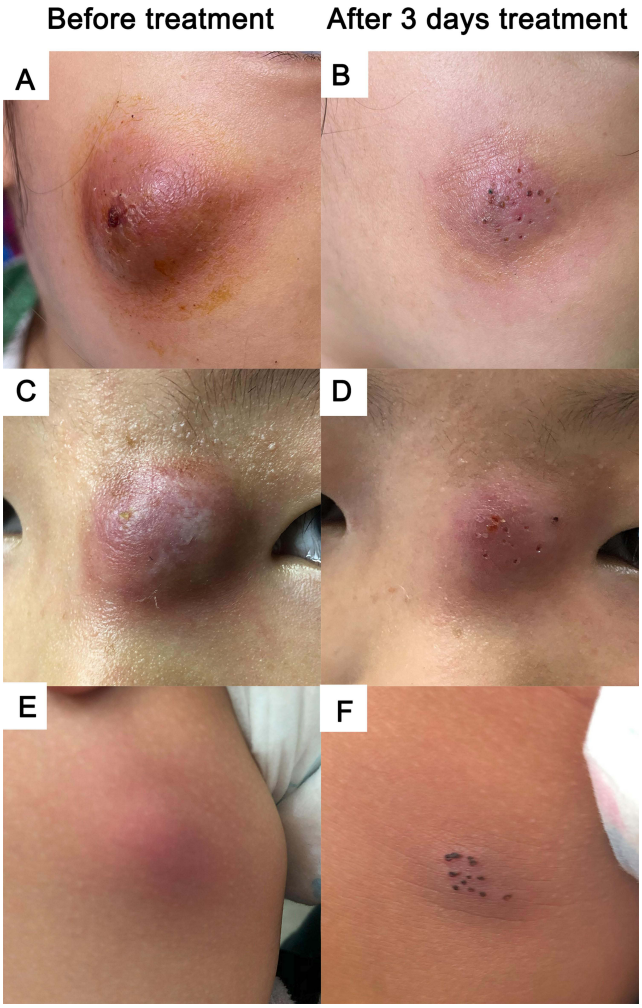


**Figure 2** Case1: A skin abscess on the face of a 3-year-old child before (**A**) and after (**B**) 3 days of fire needle combined therapy. Case 3: A skin abscess on the nasal root of a 7-year-old child before (**C**) and after (**D**) 3 days of fire needle combined therapy. Case 13: A skin abscess on the buttock of a 1-year-old child before (**E**) and after (**F**) 3 days of fire needle combined therapy.

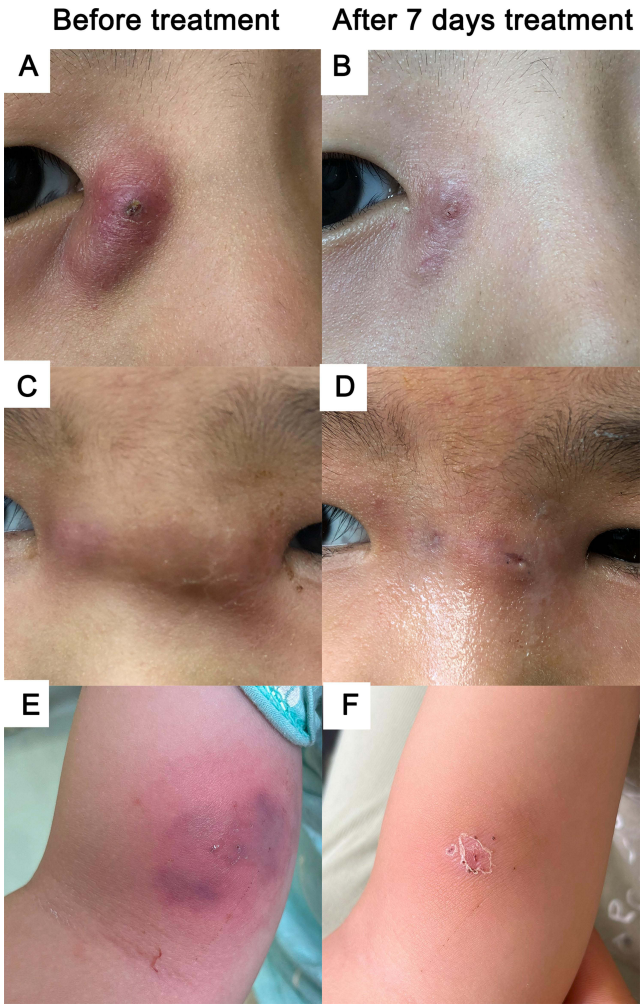


**Figure 3** Case 4: A skin abscess on the nasal root of a 5-year-old child before (**A**) and after (**B**) 7 days of fire needle combined therapy. Case 8: A skin abscess on the inner corner of the eye of an 8-year-old child before (**C**) and after (**D**) 7 days of fire needle combined therapy. Case 12: A skin abscess on the arm of a 1-year-old child before (**E**) and after (**F**) 7 days of fire needle combined therapy. (All three patients received two needle treatments, with a 3-day interval between the second treatment and the first).

was considered beneficial in controlling the further progression of the disease and minimally invasive treatment.[25] In our study, patients 11, 12 and 17 applied fire needle therapy at an early stage and had a shorter basic healing time, demonstrating the effectiveness of fire needle in the early stage of skin abscesses in children as well. Therefore, early application of combined treatment with fire needle combined therapy can prevent further aggravation of the skin abscess and avoid the impact of surgical incision and drainage on the patient's quality of life.

Among the 10 pediatric patients with lesions on the face and neck, 6 cases were extremely challenging because their lesions were located in areas such as the periocular and nasal regions, where surgical incision was inconvenient and could lead to the risk of infection. For facial skin abscesses, early incision, wound enlargement or improper treatment can result in the spread of infection, especially in areas such as the dangerous triangle of the face, prone to suppurative cavernous vein sinusitis, eye and surrounding tissue inflammation. Pannu AK reported a case of a furuncle on the tip of the nose that developed into a septic cavernous sinus thrombosis.[30] However, pediatric patients do not accept conventional surgical incision and drainage easily as surgery tends to affect appearance.[31,32] In addition, post-operative scarring can be a problematic issue as the expressions and movements of children are not easily managed.[33] The above pediatric patients were treated with fire needle combined therapy and the painful symptoms disappeared quickly and the lesions healed satisfactorily, stopping the progression of the disease and avoiding surgical incisions. Compared to surgical incision and drainage, the fire needle has the function of sterilizing and hemostatic effect at high temperatures, allowing for less bleeding by burning the small local blood vessels. Moreover, the fire needle is a substitute for a scalpel, which also

facilitates the unobstructed drainage of pus through a small wound, resulting in faster healing with a smaller opening and avoiding the aesthetic and psychological impact of post-operative scarring.[34]

At post-treatment follow-up, all pediatric patients had no significant cosmetic problems, muscle and nerve dysfunction, and no recurrences within 4 weeks. During our literature collection, we found that literature relating to fire needle therapy overwhelmingly demonstrates the safety and effectiveness of this treatment, only Huang M reported two patients with hyperplastic scars after fire needle therapy that resolved after multiple injections of tretinoin.[18] Therefore, we advocate that fire needle therapy should be applied to patients with non-cicatricial constitution and performed by professionals whenever possible.

Although this case series fills a gap in the outcome evidence for the treatment of skin abscesses in children with fire needle therapy, the data are limited by the relatively small sample size. High-quality studies such as randomized controlled studies on more diverse samples are needed to assess further the value of fire needling in the treatment of skin abscesses.

## Conclusion

Pediatric patients, especially those with skin abscesses in areas with high cosmetic or functional requirements such as the face and neck, have a relatively large aesthetic demand and incision and drainage is highly challenging. Fire needle combined therapy can significantly improve skin lesions and relieve pain and may be a more preferred treatment option in appropriate circumstances. This therapy has the advantages of less bleeding, no cosmetic impact, simple operation, and reliable curative effect, which is worthy of further research and promotion.

## Ethics Approval and Informed Consent

The research was conducted in accordance with the principles of the Declaration of Helsinki and good clinical practice guidelines. Our research has been approved by the Research Ethics Committee of the Second Hospital of Shandong University, with the number KYLL-2023LW010. The guardians of 17 patients provided written informed consent for publication of this study and accompanying images.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

All authors report no conflicts of interest in this work.

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