

# Nursing Effects of Modified Intramuscular Injection Technique in Syphilis Treatment with Benzathine Penicillin

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**Abstract:** *Objective:* To investigate the nursing effect of a modified intramuscular injection technique in the treatment of syphilis with benzathine penicillin. *Methods:* Eighty syphilis patients who underwent benzathine penicillin treatment at No. 2 People's Hospital of Fuyang City from January 2019 to December 2022 were selected as research subjects. Following the principle of random grouping, they were divided into the experimental group ( $n = 40$ ) and the control group ( $n = 40$ ). Patients in the control group received conventional intramuscular injections of benzathine penicillin, while patients in the experimental group received intramuscular injections using a modified technique. The injection pain level, injection success rate, occurrence of local adverse reactions, and other indicators in both patient groups were observed. *Results:* The injection pain level in the experimental group was significantly lower than that in the control group ( $P < 0.05$ ). Additionally, the injection success rate was significantly higher in the experimental group compared to the control group ( $P < 0.05$ ). The incidence of local adverse reactions in the experimental group was significantly lower than that in the control group ( $P < 0.05$ ). *Conclusion:* The improved intramuscular injection technique holds significant practical implications for enhancing the nursing effect of benzathine penicillin in syphilis treatment. It has the potential to improve the therapeutic outcomes of syphilis, enhance the quality of life for patients, and offer new ideas and methods for clinical nursing practices.

**Keywords:** Improved intramuscular injection technique; Benzathine penicillin; Syphilis

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## 1. Introduction

Intramuscular injection stands as a commonly employed drug delivery method widely utilized in the treatment of various diseases. However, in clinical practice, it often leads to adverse nursing effects such as pain, local muscle tension, and inflammation. These issues not only impact the patient's treatment experience and quality of life but also exert a negative influence on the patient's recovery and treatment outcomes. Consequently, enhancements in intramuscular injection techniques have become crucial in clinical nursing research.

Syphilis, a sexually transmitted disease, significantly affects the health and quality of life of patients. The

primary treatment for syphilis is benzathine penicillin. Unfortunately, intramuscular injection of benzathine penicillin during the treatment process frequently induces pain and local muscle problems, such as tension, causing considerable discomfort to patients. Therefore, investigating the nursing effect of an improved intramuscular injection technique on the treatment of syphilis with benzathine penicillin holds immense significance.

This study aims to explore the impact of enhanced intramuscular injection technique on the nursing effect of benzathine penicillin in syphilis treatment. Specifically, this study assesses the influence of improved intramuscular injection techniques, such as altering the injection angle and reducing injection pressure, on adverse nursing effects including pain level, local muscle tension, and inflammation. The goal of performing this investigation is to identify a safer and more comfortable intramuscular injection method, which will ultimately improve patients' treatment experiences and quality of life while enhancing the effectiveness and efficiency of benzathine penicillin in treating syphilis.

## **2. Materials and methods**

### **2.1. General information**

This study selected 80 syphilis patients who underwent benzathine penicillin treatment at the No. 2 People's Hospital of Fuyang City between January 2019 and December 2022 as research subjects. All patients met the clinical diagnostic criteria and were randomly assigned to either the experimental group ( $n = 40$ ) or the control group ( $n = 40$ ). The two groups were comparable in terms of gender, age, and overall health.

Inclusion criteria included patients meeting the diagnostic criteria for syphilis requiring benzathine penicillin treatment, aged between 18 and 60, regardless of gender, patients signing an informed consent form and expressing willingness to participate.

Exclusion criteria included patients allergic to benzathine penicillin or with an allergic constitution, those with severe heart, liver, kidney, or other organ diseases, patients with neurological diseases or mental disorders, pregnant and lactating women, and individuals treated with other antibiotics or participating in other clinical trials.

### **2.2. Methods**

Patients in the control group received conventional intramuscular injections of benzathine penicillin, while those in the experimental group received injections using modified techniques. The specific procedures were as follows:

- (1) Experimental group: Patients sat in an upright position, and the outer thigh muscle group served as the injection site, with a needle insertion angle of  $30^\circ$  to  $45^\circ$ . Prior to injection, blood was withdrawn, followed by slow drug administration. Nurses closely monitored patients for reactions, promptly addressing symptoms such as pain and swelling.
- (2) Control group: Patients were positioned prone, and the gluteus maximus served as the injection site, with a needle insertion angle of  $90^\circ$ . The drug was injected directly without withdrawal before injection. Nurses observed patients during the injection process, promptly addressing any signs of discomfort.

### **2.3. Observation indicators**

The study observed the injection pain level, injection success rate, occurrence of local adverse reactions, and other indicators in both patient groups. The pain level was evaluated using the visual analog scale (VAS), with a higher score indicating increased pain levels. The injection success rate was based on the success of a single

injection. Local adverse reactions encompassed redness, swelling, induration, itching, etc.

## 2.4. Statistical methods

SPSS 22.0 software was employed for data processing and analysis. Measurement data are expressed as mean  $\pm$  standard deviation (SD), with  $t$ -tests used for intergroup comparisons. Count data are expressed as percentages (%), and  $\chi^2$  tests are utilized for intergroup comparisons. A significance level of  $P < 0.05$  indicates statistical significance.

## 3. Results

### 3.1. Comparison of injection pain levels

As shown in **Table 1**, the injection pain level in the experimental group was significantly lower than that in the control group ( $P < 0.05$ ).

**Table 1.** Comparison of injection pain levels between the two groups of patients (mean  $\pm$  SD, points)

Group	<i>n</i>	VAS score
Experimental group	40	3.21 $\pm$ 1.11
Control group	40	5.62 $\pm$ 1.34
<i>t</i>		9.88
<i>P</i>		< 0.05

### 3.2. Comparison of injection success rates

Patients in the experimental group exhibited a significantly higher injection success rate compared to the control group ( $P < 0.05$ ), as seen in **Table 2**.

**Table 2.** Comparison of injection success rates between two groups of patients [*n* (%)]

Group	<i>n</i>	One injection success rate
Experimental group	40	38 (95.00)
Control group	40	30 (75.00)
$\chi^2$		6.27
<i>P</i>		< 0.05

### 3.3. Comparison of local adverse reactions

As shown in **Table 3**, the incidence of local adverse reactions in the experimental group was significantly lower than that in the control group ( $P < 0.05$ ).

**Table 3.** Comparison of local adverse reactions between the two groups of patients [*n* (%)]

Group	Local redness and swelling	Induration	Itching	Incidence
Experimental group ( <i>n</i> = 40)	1	0	1	2 (5.00)
Control group ( <i>n</i> = 40)	4	2	3	9 (22.50)
$\chi^2$				5.16
<i>P</i>				< 0.05

## 4. Discussion

The incubation period of syphilis typically spans 2 to 4 weeks following infection. *Treponema pallidum* requires a certain duration to elicit an immune response after entering the human body. During this phase, patients may remain asymptomatic. The manifestation of syphilis begins with a chancre, usually appearing around 2 weeks post-infection and becoming more evident by 4 weeks. Chancres can emerge anywhere on the body but are most prevalent in the genital area. Typically, they present as single, painless ulcers measuring 1 to 2 cm, featuring surface exudate and induration at the base. As the condition progresses, patients may experience systemic symptoms such as fever, headache, muscle pain, and fatigue. These symptoms may manifest in the first week after infection or even months or years later. In the early stages of syphilis, swollen lymph nodes may also be observed near the chancre or in other body parts. Disease progression may lead to diverse skin and mucosal lesions, including macules, papules, blisters, pustules, and genital warts. These lesions can appear anywhere on the body but are most commonly found on the palms, soles, and around the genitals. In later stages, neurological lesions may develop, presenting symptoms such as headaches, dizziness, visual impairment, hearing impairment, and, in severe cases, paralytic dementia or tuberculosis. Serological examination, a vital diagnostic method, confirms syphilis 4 to 6 weeks after infection by detecting *Treponema* antibodies<sup>[1-6]</sup>.

Benzathine penicillin exhibits robust antibacterial activity against *Treponema pallidum*, exerting a bactericidal effect by inhibiting bacterial cell wall synthesis. Additionally, benzathine penicillin can disrupt the integrity of the bacterial cytoplasmic membrane, thereby inhibiting bacterial growth and reproduction. Typically administered intramuscularly to treat syphilis, the specific treatment involves determining the injection dose based on the patient's condition and weight. Intramuscular injections, ranging from 2.4 to 3.6 million units each time, with 1.2 to 1.8 million units injected into each buttock muscle weekly for 2 to 4 weeks, are commonly employed to enhance therapeutic efficacy. This treatment approach can be complemented by other drug treatments, such as oral antibiotics<sup>[7,8]</sup>. Benzathine penicillin proves effective in treating syphilis, leading to the gradual disappearance of symptoms and a negative serum response post-treatment. Subsequent to recovery, regular reexaminations are essential to ensure effective disease control. Intramuscular injection stands as a standard method for clinically treating syphilis, with factors like pain level during the injection, injection success rate, and local adverse reactions crucially influencing patient treatment compliance and effectiveness.

In this study, the experimental group exhibited a significantly lower injection pain score ( $3.21 \pm 1.11$  points) compared to the control group ( $5.62 \pm 1.34$  points;  $P < 0.05$ ). The injection success rate was notably higher in the experimental group (95%) than in the control group (75%;  $P < 0.05$ ). The incidence of local adverse reactions in the experimental group (5%) was significantly lower than that in the control group (22.5%;  $P < 0.05$ ). These findings suggest that the use of modified technique intramuscular injection techniques effectively reduces injection pain, enhances the injection success rate, and diminishes the occurrence of local adverse reactions. This improvement holds significant promise for enhancing patients' quality of life and treatment outcomes and merits widespread clinical application.

Traditional intramuscular injection methods often result in pain and an unstable injection success rate. Recent research focuses on improved techniques to enhance the therapeutic efficacy of benzathine penicillin and patient care outcomes. Pain, a common side effect, especially in long-term injections, can be mitigated through modified techniques, including more comfortable positioning, accurate injection angles, and efficient needle insertion methods. Studies indicate that these modifications significantly reduce pain, improving patient comfort and satisfaction<sup>[10-12]</sup>. Simultaneously, this improved technique can also improve patient compliance with treatment and reduce the number of patients who refuse treatment due to pain.

The injection success rate, a critical indicator to measure the effect of intramuscular injection, can be compromised in traditional methods, leading to unsuccessful injections and increased patient pain. Enhanced intramuscular injection technique, with more accurate injection angles and effective needle insertion methods, significantly improves the success rate and reduces the need for multiple injections<sup>[13-15]</sup>. This improvement not only enhances treatment effects but also reduces patient suffering and conserves medical resources.

Local adverse reactions, such as redness, swelling, induration, and itching, can occur after intramuscular injections. Improved intramuscular injection technique adjusts injection techniques and drug preparation methods, substantially decreasing the occurrence of local adverse reactions<sup>[16]</sup>. Besides physiological effects, the improved technique also addresses patients' mental health, alleviating anxiety and fear through communication and psychological counseling. Studies show that improved intramuscular injection techniques significantly reduce patients' psychological stress and uneasiness<sup>[17]</sup>.

In summary, employing an improved intramuscular injection technique for benzathine penicillin in syphilis treatment reduces patient pain, enhances the injection success rate, and diminishes the incidence of local adverse reactions, ultimately improving the patient's quality of life and treatment outcomes. These results have broader applications in the treatment of various diseases, offering valuable reference and guidance for clinical nursing practice. This study not only holds significance for syphilis treatment but also plays a positive role in advancing clinical nursing practice.

## Disclosure statement

The author declares no conflict of interest.

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