

# Analgesic Effect of Combined Spinal-Epidural Anesthesia and its Effect on TNF- $\alpha$ and CRP Levels in Elderly Patients with Hip Fracture During Surgical Treatment

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**Abstract:** *Objective:* To observe the analgesic effect of combined spinal and epidural anesthesia on older patients undergoing hip fracture surgery. *Method:* One hundred and twenty elderly hip fracture surgery patients treated in our hospital from January 2021 to December 2022 were selected and randomly divided into two groups, with 60 cases in the experimental group and 60 in the control group. The experimental group was given combined spinal-epidural anesthesia intervention measures, while the control group was given epidural anesthesia intervention measures. The analgesic effect, tumor necrosis factor-alpha (TNF- $\alpha$ ), C-reactive protein (CRP) levels, and other observation indicators were analyzed after anesthesia intervention. *Result:* After the intervention, the analgesic effect and the evaluation results of the subjects in the experimental group were better than those in the control group ( $P < 0.05$ ); the obtained values of TNF- $\alpha$  and CRP levels in the experimental group were higher than those of the control group ( $P < 0.05$ ). *Conclusion:* The combined spinal-epidural anesthesia intervention demonstrated positive outcomes. The analgesic effect of patients during surgery and their inflammatory factor levels improved, which makes this intervention worthy of clinical application and promotion.

**Keywords:** Hip fracture in the elderly; Surgery; Combined spinal and epidural anesthesia; Analgesic effect; TNF- $\alpha$ ; CRP level

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## 1. Introduction

Hip fracture is a common orthopedic disease that mainly affects the older population<sup>[1]</sup>. This is mainly due to their advanced age, as the body's various functions and immunity are in a state of decline. Additionally, hip fractures can be caused by exposure to other external factors, like falls. To improve the patient's symptoms, timely and active therapeutic intervention is required, and surgery is often applied in clinical treatment. However, as older patients are often accompanied by other diseases, this increases the risk of surgery and makes anesthetic intervention difficult. Epidural anesthesia is often used in clinical practice, but its analgesic effect

is not ideal <sup>[2,3]</sup>. As a new mode of anesthesia, combined spinal-epidural anesthesia has a faster onset of action, achieves ideal muscle relaxation effects, and is much safer. However, the actual effect of this anesthetic method needs to be further studied.

## 2. Materials and methods

### 2.1. General information

The research subjects included 120 elderly hip fracture patients treated in our hospital from January 2021 to December 2022. After enrollment, the patients were divided into groups randomly, with 60 cases in the experimental group and 60 in the control group.

The control group consisted of 33 males and 27 females aged 70–91 years old, with an average age of  $78.69 \pm 3.64$  years. The experimental group consisted of 34 males and 26 females aged 71–90 years old, with an average age of  $78.71 \pm 3.69$  years. A comparison of the basic information (gender and age) of the subjects showed no significant difference ( $P > 0.05$ ).

Inclusion criteria: (1) Patients with good communication skills; (2) consented. Exclusion criteria: (1) Patients with other malignant tumors; (2) Other hematological diseases and major infectious diseases; (3) serious heart, liver, and kidney diseases; (4) patients with contraindications for surgery.

### 2.2. Methods

During the surgery, changes in vital signs such as heart rate and blood pressure were monitored in real-time, and upper limb venous access and mask oxygen intervention were implemented when necessary.

The control group received epidural anesthesia intervention. According to the patient's condition, L<sub>2-3</sub> or L<sub>3-4</sub> interspace puncture intervention was performed. After that, a trial intervention was implemented where 3–4 mL of 1.5% lidocaine (Shandong Hualu Pharmaceutical Co., Ltd.; approval number: National Drug Approval No. H37022147) was applied. An anesthesia plane test was carried out without exceeding the T<sub>8-10</sub> level, and 5–8 mL of lidocaine was administered until the anesthesia effect was satisfactory. During the surgery, the patient's vital signs were closely monitored, and any abnormalities were handled in cooperation with the physician <sup>[4]</sup>.

The experimental group received combined spinal and epidural anesthesia intervention. According to the patient's condition, L<sub>2-3</sub> or L<sub>3-4</sub> interspace puncture intervention was performed. After that, spinal epidural anesthesia and puncture trocar were used to perform the puncture operation, and then the configured pen-tip lumbar puncture needle was inserted. After the cerebrospinal fluid has flown out, 1–1.2 mL of 0.75% bupivacaine (Shanghai Zhaohui Pharmaceutical Co., Ltd.; approval number: National Drug Approval H20056442) and 0.3 mL of 5% glucose (production company: Sichuan Kelun Pharmaceutical Co., Ltd.; Approval number: National Drug Approval No. H20043933) was added, followed by the injection of 0.2 mL of cerebrospinal fluid. The injection speed was maintained at 0.05 mL/s. After the injection was completed, the epidural catheter was inserted 3.5 cm from the head end. The patient was instructed to lie down and the anesthesia plane was adjusted, without exceeding T<sub>10</sub>. The patient's vital signs are closely monitored during surgery and any abnormalities are handled in cooperation with the physician.

### 2.3. Observation indicators

#### 2.3.1. Analgesic effects

The specific patient pain scores at 8 h, 12 h, and 24 h after surgery during the study of the pain numerical rating scale (NRS) were recorded with a score of 0–10. The score was inversely proportional to the analgesic effect.

### 2.3.2. TNF- $\alpha$ and CRP levels

Specific changes in the patients' TNF- $\alpha$  (tumor necrosis factor- $\alpha$ ) and CRP levels (C-reactive protein) were recorded.

### 2.4. Statistical analysis

Statistical analysis was carried out using the SPSS 26.0 software. The measurement data was expressed as mean  $\pm$  standard deviation and analyzed using the *t*-test. Count data were compared using the chi-squared ( $\chi^2$ ) test. Results were considered statistically significant at  $P < 0.05$ .

## 3. Results

### 3.1. Analgesic effect

**Table 1** shows the changes in the analgesic effect of the two groups of patients after anesthesia intervention. The pain scores of the experimental group at 8 h, 12 h, and 24 h after surgery were  $2.86 \pm 0.51$ ,  $2.23 \pm 0.32$ , and  $1.60 \pm 0.29$ , while those of the control group were lower at  $3.67 \pm 0.83$ ,  $2.54 \pm 0.40$ , and  $2.19 \pm 0.33$ , respectively.

**Table 1.** Comparison of analgesic effects (mean  $\pm$  standard deviation, points)

| Group                           | 8 h             | 12 h            | 24 h            |
|---------------------------------|-----------------|-----------------|-----------------|
| Control group ( $n = 60$ )      | $3.67 \pm 0.83$ | $2.54 \pm 0.40$ | $2.19 \pm 0.33$ |
| Experimental group ( $n = 60$ ) | $2.86 \pm 0.51$ | $2.23 \pm 0.32$ | $1.60 \pm 0.29$ |
| <i>t</i>                        | 6.441           | 4.688           | 10.403          |
| <i>P</i>                        | 0.000           | 0.000           | 0.000           |

### 3.2. TNF- $\alpha$ and CRP levels

**Table 2** shows the changes in TNF- $\alpha$  and CRP levels of the two groups of patients after anesthesia intervention. The TNF- $\alpha$  and CRP levels of the experimental group were lower than those in the control group after anesthesia intervention ( $P < 0.05$ ).

**Table 2.** Comparison of TNF- $\alpha$  and CRP levels (mean  $\pm$  standard deviation)

| Group                           | TNF- $\alpha$ (ng/L) | CRP (mg/L)       |
|---------------------------------|----------------------|------------------|
| Control group ( $n = 60$ )      | $102.71 \pm 7.43$    | $28.26 \pm 2.54$ |
| Experimental group ( $n = 60$ ) | $85.24 \pm 7.35$     | $22.38 \pm 2.12$ |
| <i>t</i>                        | 12.948               | 13.767           |
| <i>P</i>                        | 0.000                | 0.000            |

## 4. Discussion

Hip fracture is a common injury among the elderly. As the patient ages, the severity of osteoporosis increases. Therefore, as the aging phenomenon in China has intensified in recent years, the incidence of hip fractures has gradually increased. Patients often experience hip joint deformity after fracture<sup>[5]</sup>, which not only seriously affects the patient's health but also has a serious impact on the patient's daily life, causing a sudden decrease in their quality of life. Hip replacement surgery can improve hip joint function and relieve pain. However,

older patients have poorer tolerance for surgery, hence there is a need for more effective and safer anesthesia measures<sup>[6,7]</sup>. Combined spinal-epidural anesthesia is a new intervention measure that can effectively reduce surgical risks, improve anesthesia outcomes, and have a better prognosis.

In this study, patients in the experimental group were selected to undergo combined spinal-epidural anesthesia intervention and the patients' analgesic effect was improved. As compared to the control group, the experimental group's pain relief was improved between 8h, 12h, and 24h after surgery, with a lower pain score ( $P < 0.05$ ). Moreover, the levels of TNF- $\alpha$  and CRP in the experimental group were lower than those of the control group ( $P < 0.05$ ). This finding was consistent with the research by Weng and Fan<sup>[8]</sup>. The analgesic effect of patients in the observation group was better than that of the control group ( $P < 0.05$ ) and the index comparison was similar, indicating that combined spinal-epidural anesthesia intervention demonstrated better patient outcomes. Older patients with hip fractures are often accompanied by intervertebral foraminal occlusion. During epidural anesthesia intervention, they are accompanied by hearing impairments, consciousness disorders, etc., making it difficult for them to express themselves. Due to this, the anesthesia induction time is affected, and the dose control is not ideal, hence the risk of surgery complications increases<sup>[9,10]</sup>. However, combined spinal-epidural anesthesia uses a relatively small dose of drugs and has a faster onset of action. It can accurately predict the anesthetic effect, perform adjustments, achieve complete muscle relaxation, and ensure high anesthesia quality. At the same time, it can positively inhibit the release of inflammatory factors during surgery, improve the prognosis, effectively relieve the patient's pain after surgery, and improve their treatment compliance. Its analgesic effect is advantageous and effectively promotes the patient's postoperative recovery. Nonetheless, this study still has shortcomings. The sample size is relatively small, and further studies are required to analyze the long-term effects of this procedure.

## 5. Conclusion

The combined spinal and epidural anesthesia during hip fracture surgery in the elderly has achieved positive outcomes. This intervention improved patients' analgesic effect and lowered their TNF- $\alpha$  and CRP levels. Moreover, compared with the implementation of epidural anesthesia intervention alone, the combined intervention is more suitable for widespread promotion.

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## Disclosure statement

The authors declare no conflict of interest.

## References

- [1] Zhang Z, 2023, Application of Spinal Anesthesia Combined with Epidural Anesthesia in Surgery for Elderly Patients with Hip Fracture. *Huaihai Medicine*, 41(4): 394–396.
- [2] Wang X, Wen J, Wang C, 2022, Optimization of Anesthesia Strategies for Hip Fracture Surgery in Elderly Patients. *Journal of Clinical and Pathology*, 42(3): 708–714.

- [3] Liu J, Liu Z, Chen Y, et al., 2022, Comparison of the Effects of Two Anesthesia Methods for Hip Fracture Surgery in the Elderly. *Journal of Clinical Orthopedics*, 25(6): 826–828.
- [4] Zhu X, 2021, Analysis of the Analgesic Effect of Combined Spinal-Epidural Anesthesia During Surgery in Elderly Patients with Hip Fractures. *Chinese Practical Medicine*, 16(33): 73–75.
- [5] Ren X, 2021, Evaluation of the Effectiveness of Combined Spinal-Epidural Anesthesia in Elderly Patients with Hip Fracture. *Chinese Disability Medicine*, 29(22): 36–37.
- [6] Ma M, 2021, Safety Study of Combined Spinal-Epidural Anesthesia in Elderly Patients with Hip Fracture. *Chinese Practical Medicine*, 16(17): 108–110.
- [7] Li X, Zhang J, Zhu Q, et al., 2021, Safety of Combined Anesthesia in Elderly Patients with Hip Fracture. *Heilongjiang Traditional Chinese Medicine*, 50(2): 14–15.
- [8] Weng C, Fan H, 2020, Safety of combined spinal-epidural anesthesia for elderly patients with hip fracture. *Medical Theory and Practice*, 33(1): 90–91.
- [9] Yang Z, Wang K, Huang Z, et al., 2021, Clinical Study on the Relationship Between Pre-Operative Nottingham Score and Postoperative Complications in Elderly Patients with Hip Fracture [J]. *Journal of Clinical and Experimental Medicine*, 20(20): 2181–2185.
- [10] Lu X, 2020, Safety of Combined Spinal-Epidural Block Anesthesia in Elderly Patients with Hip Fracture. *Medical Equipment*, 33(17): 130–131.

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