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*Original Article*

# Comparison of clinical effects of general anesthesia and intraspinal anesthesia on total hip arthroplasty

Tao Zhang[1*], Yan Ma[2*], Lei Liu[3], Jie Wang[4], Xiankui Jia[5], Yuguo Zhang[1], Yiming Dong[3]

*[1]Department of Anesthesiology, Ji'nan Hospital of Integrated Traditional Chinese and Western Medicine, Ji'nan, Shandong Province, China; [2]Department of Anesthesiology, Gucheng County Hospital of Hebei Province (The Eighth People's Hospital of Hengshui), Hengshui, Hebei Province, China; [3]Department of Anesthesiology, The Second People's Hospital of Dongying, Dongying, Shandong Province, China; [4]Department of Anesthesiology, Wei County Hospital of Traditional Chinese Medicine, Handan, Hebei Province, China; [5]Department of Anesthesiology, Heze Dingtao People's Hospital, Heze, Shandong Province, China. [*]Equal contributors and co-first authors.*

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**Abstract:** Objective: To evaluate the clinical effects of general anesthesia and intraspinal anesthesia on total hip arthroplasty. Methods: A total of 110 patients who underwent unilateral total hip arthroplasty in our hospital were randomly divided into the observation group and the control group, with 55 patients in each group. The observation group was given intraspinal anesthesia, while the control group was given general anesthesia. The excellent anesthesia rate, intraoperative blood pressure, intraoperative heart rate, observation time in the postoperative recovery room, the incidence of complications and hospitalization time were observed and compared between the two groups. Results: Compared with the control group, the excellent anesthesia rate of the observation group increased ($P<0.05$). The observation time in the postoperative recovery room, intraoperative blood pressure, intraoperative heart rate and incidence of complications in the observation group were lower than those in the control group (all $P<0.05$). The hospitalization time of the observation group was significantly shorter than that of the control group ($P<0.05$). Conclusion: Intraspinal anesthesia in total hip arthroplasty can significantly improve the excellent anesthesia rate, help maintain the intraoperative blood pressure and heart rate and reduce the observation time in the postoperative recovery room, incidence of complications and hospitalization time of patients, which can be recommended in clinical application.

**Keywords:** Total hip arthroplasty, general anesthesia, intraspinal anesthesia, excellent anesthesia rate, complication

## Introduction

Hip diseases such as femoral head necrosis and femoral neck fractures can affect the patients' motor function and even lead to disability of the affected limb, can severely affect the patients' quality of life [1-3]. Epidemiological surveys show that the elderly are the high-risk population of hip diseases due to osteoporosis, old age and drug use [4-8]. In China, the incidence of hip diseases is close to 10% in people over 60 years old, and is increasing with the aging population. Hip diseases are one of the primary orthopedic diseases affecting the elderly's health in China [9, 10].

Total hip arthroplasty is an effective treatment for hip diseases, and adequate anesthesia is essential for implementing the operation [11]. In the past, general anesthesia was considered to be the gold standard for hip surgery. However, recent studies have shown that elderly patients with hip diseases are often accompanied with cardiovascular and cerebrovascular diseases, which increases the incidence of adverse anesthetic events, while intraspinal anesthesia can reduce the incidence of the above adverse events to a certain extent [12, 13]. In this study, we compared the clinical effects of general anesthesia and intraspinal anesthesia in total hip arthroplasty, hoping to provide more evidence-based bases for optimizing clinical anesthesia in hip surgery.

## Materials and methods

### *General information*

One hundred and ten patients who underwent total hip arthroplasty in our hospital from

January 2019 to December 2020 were recruited in this prospective study. The patients were randomly divided into the observation group and the control group, each group containing 55 patients. The observation group received intraspinal anesthesia, while the control group received general anesthesia.

The inclusion criteria were: 18-70 years old; No contraindications to intraspinal anesthesia; No contraindications to general anesthesia; Preoperative ASA class II-III (according to the patient's constitution and the risk of surgery, the ASA classification divided the patient's preoperative condition into six classes, higher class indicating a higher risk of surgery) [14]. Unilateral hip surgery. The exclusion criteria were: A history of hip surgery; Opioid addicts; Dysfunction of liver, kidney, brain or other major organs; Preoperative infection; Coagulation dysfunction; Mental diseases. All patients agreed to this study and signed the informed consent. This study was approved by the Ethics Committee of our hospital.

*Surgical methods*

Preoperative preparation. All patients in the two groups received routine preoperative preparation. The night before the operation, patients were given 10 mg of diazepam (5 mg/tablet, Chengdu Beite Pharmaceutical Co., Ltd., China), fasted for 8 h and deprived of water for 4 h. Half an hour before the operation, patients were intramuscularly injected with phenobarbital (Harbin Pharmaceutical Group, China) to relieve the tension and atropine (Changchun Changhong Pharmaceutical Co., Ltd., China) to reduce the secretion of various glands.

*General anesthesia in the control group:* In our hospital, midazolam (Enha Medicine, Hebei, China), sufentanil (Renfu Pharmaceutical Co., Ltd., Yichang, China), cis-atracurium (Dongying Pharmaceutical Co., Ltd., Jiangsu, China) and propofol (AstraZeneca Pharmaceuticals Co., Ltd., the United States) were used for general anesthesia. The endotracheal tube with an appropriate diameter was used for tracheal intubation. The dosage of narcotic drugs was adjusted according to the depth of anesthesia, the degree of muscle relaxation and operation progress.

*Intraspinal anesthesia in the observation group:* The main operation of intraspinal anesthesia was as follows. L2-L3 was taken as the puncture point, and the puncture depth was 4 cm. Levobupivacaine was used for the nerve block, and T10 was selected as the anesthesia plane. The dosage of drugs was adjusted according to the intraoperative situation.

*Outcome measures*

*Primary outcome measures:* Excellent anesthesia rate. According to the degree of muscle traction, the anesthesia effect was divided into three grades: excellent, good and poor. Muscles in complete relaxation and no pain in muscle traction were considered excellent. Slight discomfort in muscle traction which did not interrupt the operation was considered good. Severe discomfort in muscle traction was considered poor. The excellent anesthesia rate (%) = (excellent cases + good cases)/total cases *100 [15].

*Secondary outcome measures:* The secondary outcome measures included intraoperative mean blood pressure and heart rate, the incidence of complications, observation time in the postoperative recovery room and hospitalization time. Complications included tachycardia, hypotension and infection. The observation time in the postoperative recovery room referred to the time when the patients entered the recovery room after completing the operation until their condition was stable and left the recovery room. The hospitalization time referred to the time from hospitalization to discharge.

*Statistical analysis*

All data were analyzed by SPSS 22.0 statistical analysis software. The measurement data were displayed as mean ± standard deviation ($\bar{x}$ ± sd), and the comparison between the two groups was conducted by independent t-test. The enumeration data were displayed as (n, %), and the comparison between the two groups was conducted by the $\chi^2$ test. $P<0.05$ was considered statistically significant.

## Results

*Comparison of general information between the two groups*

General information such as age, gender, ASA class, affected limb and etiology showed no

**Table 1.** Comparison of general information between the two groups (n, $\bar{x}$ ± sd)

| Group | Observation group (n=55) | Control group (n=55) | $t/\chi^2$ | P |
|---|---|---|---|---|
| Gender (male/female) | 30/25 | 27/28 | 0.146 | 0.703 |
| Age (years) | 61.2±4.3 | 60.9±4.7 | 0.349 | 0.728 |
| Preoperative ASA classification | | | 0.940 | 0.330 |
| Class II | 19 | 25 | | |
| Class III | 36 | 30 | | |
| Affected limb | | | 0.036 | 0.849 |
| Left | 29 | 27 | | |
| Right | 26 | 28 | | |
| Etiology | | | 0.636 | 0.425 |
| Femoral neck fractures | 17 | 22 | | |
| Femoral head necrosis | 38 | 33 | | |

**Table 2.** Comparison of excellent anesthesia rate between the two groups (n, %)

| Group | Anesthesia effect | | | Excellent anesthesia rate (%) |
|---|---|---|---|---|
| | Excellent | Good | Poor | |
| Observation group (n=55) | 25 | 28 | 2 | 96.36 |
| Control group (n=55) | 21 | 24 | 10 | 81.82 |
| $\chi^2$ | | | 4.583 | |
| P | | | 0.032 | |

**Table 3.** Comparison of intraoperative blood pressure and heart rate between the two groups ($\bar{x}$ ± sd)

| Group | Systolic blood pressure (mmHg) | Diastolic blood pressure (mmHg) | Heart rate (beats per minute) |
|---|---|---|---|
| Observation group (n=55) | 99.8±9.7 | 78.3±6.5 | 82.4±2.6 |
| Control group (n=55) | 105.2±8.6 | 81.3±6.4 | 89.8±3.0 |
| t | 3.089 | 2.439 | 13.824 |
| P | 0.003 | 0.016 | 0.000 |

statistical significance and was comparable between the two groups (all P>0.05). See **Table 1**.

*Comparison of excellent anesthesia rate between the two groups*

The excellent anesthesia rate in the observation group was higher than that in the control group (P<0.05), which preliminarily showed that intraspinal anesthesia could improve the excellent anesthesia rate. See **Table 2**.

*Comparison of intraoperative blood pressure and heart rate between the two groups*

The mean values of systolic blood pressure, diastolic blood pressure and heart rate in the observation group were significantly lower than those in the control group (all P< 0.05), which indicated that intraspinal anesthesia was more helpful to the stability of blood pressure and heart rate in patients undergoing total hip arthroplasty to a certain extent. See **Table 3**.

*Comparison of observation time in the postoperative recovery room and hospitalization time between the two groups*

The observation time in the postoperative recovery room and total hospitalization time in the observation group were lower than those in the control group (both P<0.05), which preliminarily indicated that intraspinal anesthesia could promote the postoperative recovery of patients after total hip arthroplasty. See **Figures 1**, **2**.

*Comparison of incidence of complications between the two groups*

The incidence of complications in the observation group was lower than that in the observation group (P<0.05), which preliminarily showed that intraspinal anesthesia could reduce the incidence of complications in patients after total hip arthroplasty to a certain extent. See **Table 4**.

## Discussion

Total hip arthroplasty is one of the common orthopedic operations in clinical practice. It can relieve the pain of patients' hip joint, correct deformity, restore its function and ultimately improve the patients' quality of life; thus, it is widely used in hip joint diseases such as osteoarthritis and traumatic arthritis [16]. Hip joint diseases are common in the elderly who are combined with various basic

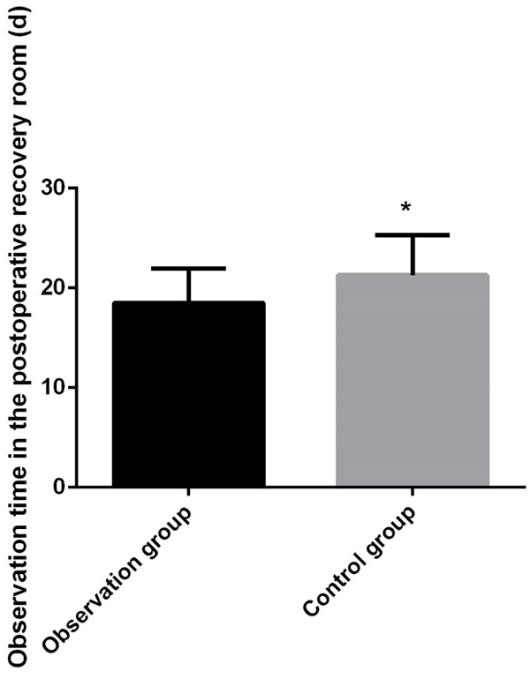


**Figure 1.** The observation time in the postoperative recovery room of the two groups. Compared with the observation group, *P<0.05.

diseases. Therefore, the appropriate anesthesia method is of great significance to the perioperative medical safety of patients [17].

In general anesthesia, anesthetics enter the body through the respiratory tract and veins to inhibit the central nervous system, while intraspinal anesthesia mainly acts on the local nerve roots to cooperate with the operation process [18]. Although general anesthesia can achieve an appropriate anesthetic effect, it has a certain degree of inhibition on cardiovascular, respiratory and digestive systems, which increases the insecurity of surgery to a certain extent. Intraspinal anesthesia increases the safety of surgery due to local nerve block [19].

The results of this study showed that the excellent anesthesia rate and the stability of circulation in the observation group were better than those in the control group, which was closely related to the fast onset and simplified operation procedure of intraspinal anesthesia and it showed better anesthesia effect than that of sensory nerve sympathetic block. Meanwhile, the patients are conscious and less affected in their circulatory system during intraspinal anesthesia, and the route of intraspinal administration is less stimulating than intravenous administration, which improves the stability of hemodynamics. The results of this study conformed with previous research conclusions about the excellent anesthesia rate and circulatory stability of intraspinal anesthesia [20, 21].

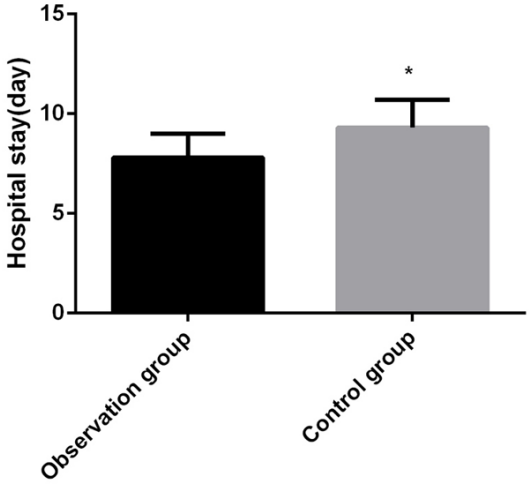


**Figure 2.** The hospitalization time of the two groups. Compared with the observation group, *P<0.05.

This study also showed that intraspinal anesthesia could reduce observation time in the postoperative recovery room and hospitalization time. The reason may be that general anesthesia increases the postoperative recovery time and hemodynamic observation time, thus prolonging the observation time in the postoperative recovery room. Tracheal intubation in general anesthesia may lead to respiratory tract infection, increase the hospitalization time of patients, which has been reported previously [22].

As to the safety of the two anesthesia methods, the results of this study showed that the incidence of complications of intraspinal anesthesia was lower than that of general anesthesia, which was related to the weak inhibition of circulation, respiratory and digestive systems and the exemption of tracheal intubation related complications in intraspinal anesthesia. A previous study also observed the low incidence of complications in spinal anesthesia [23].

This study still has some shortcomings. It was a single-center study with a small number of enrolled patients. A multi-center large-sample

**Table 4.** Comparison of incidence of complications between the two groups (n, %)

| Group | Complication | | | Total incidence (%) |
|---|---|---|---|---|
| | Tachycardia | Hypotension | Infection | |
| Observation group (n=55) | 8 | 3 | 1 | 21.82 (12/55) |
| Control group (n=55) | 15 | 7 | 3 | 45.45 (45/55) |
| $\chi^2$ | | | | 5.864 |
| P | | | | 0.015 |

study should be conducted to further confirm the clinical effect of intraspinal anesthesia in total hip arthroplasty. Long-term follow-up of anesthesia-related indicators should also be taken into consideration, which is an essential supplement to the observation of the clinical effect of intraspinal anesthesia.

In conclusion, compared with general anesthesia, intraspinal anesthesia can increase the excellent anesthesia rate, stabilize hemodynamics, reduce the incidence of complications and promote the recovery process of patients.

## Disclosure of conflict of interest

None.

**Address correspondence to:** Yiming Dong, Department of Anesthesiology, The Second People's Hospital of Dongying, No. 28 Changchun Road, Dawang Town, Guangrao County, Dongying 257-335, Shandong Province, China. Tel: +86-0546-6625571; E-mail: dongyiming6611@163.com

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