



A Study on MIS-DAA Safety and Application for Aged Patients with Nerve Blocking Anesthesia

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Abstract

Background/Objective: To study the safety of Minimally Invasive Surgery - Direct Anterior Approach (MIS-DAA) and its application among aged patients with nerve-blocking Anesthesia.

Methods: In total, 54 patients (71 to 90 years of age) who accepted MIS-DAA in our hospital were divided into nerve-blocking Anesthesia (Group A) and waist hard joint Anesthesia group (group B; contrast group). The following indexes were observed: haemodynamics, albumin, deviations of haemoglobin and albumin before and after operation, operation time, intraoperative fluid intake, postoperative pain score, landing time (Shimoji time), duration of hospitalization, and postoperative complications.

Results: The two groups of patients were nearly identical ($P > 0.05$) in terms of operation time and postoperative drainage, as well as deviations of haemoglobin and albumin before and after operation. However, haemodynamics and intraoperative fluid intake of group A were less than those of group B. Postoperative pain score, landing time, and duration of hospitalization of group A were better than those of group B ($P < 0.05$).

Conclusion: Compared with traditional combined spinal-epidural Anesthesia, nerve-blocking Anesthesia used during MIS-DAA provides minimal effects on haemodynamics, reduced postoperative pain, and more rapid recovery.

The Translational Potential of this Article: In our article, we introduced a minimally invasive surgery approach, which was conducted with nerve-blocking Anesthesia. It was simple and safety, especially for the aged patients. We believe that it has great translational potential used in the future hip joint surgery.

Keywords: Elderly Patients; Fast Recovery; MIS-DAA; Nerve Blocking

Introduction

With the aging structure of China's social population, hip fracture and femoral head necrosis among elderly adults are increasing. As a method of curing hip disease, Minimally Invasive Surgery-Direct Anterior Approach (MIS-DAA) has been widely used in clinic settings for many years. Nociceptive stimuli, such as surgery and Anesthesia in elderly patients undergoing MIS-DAA, affect the stress response, postoperative rehabilitation, and functional exercise at early stages postoperatively [1]. Further, MIS-DAA outcomes are often affected by each patient's physiological characteristics, including intraoperative stress situation, blood rheology index, immune function, and complications after

displacement [2,3]. The main anesthetic methods during hip replacement in elderly patients comprise general Anesthesia, lumbar puncture Anesthesia, and epidural Anesthesia [4]. In recent years, surgical manipulation of lower extremities under ultrasound-guided nerve block Anesthesia has achieved remarkable results, and its application has become increasingly extensive [5]. In addition, MIS-DAA has gained consensus approval worldwide. Clinical experience and results show that this approach can reduce the pain of the patient, as well as enhance early postoperative recovery and provide improved hip joint function [6,7]. The authors investigated whether, combined with the dual advantages of Anesthesia and surgery, under the guidance of modern rapid rehabilitative surgery, MIS-DAA brings safer surgical treatment and more rapid postoperative recovery for elderly patients. This study mainly considers the safety and practicability of rapid

postoperative recovery for aged patients with nerve-blocking Anesthesia during MIS-DAA.

Materials and Methods

General Material

This retrospective study analyzed clinical data of elderly patients who underwent MIS-DAA in our hospital from December 2016 to December 2017. Inclusion criteria were as follows: first-time unilateral MIS-DAA patients who exhibited American Society of Anesthesiologists (ASA) Class II-III and Body Mass Index (BMI) of $< 25 \text{ kg/m}^2$; no serious heart and lung disease or electrolysis disorders; no contraindications for peripheral nerve block or epidural Anesthesia; no recent use of glucocorticoids, no conscious dysfunction or abnormal mental diseases; no allergies to narcotic drugs or unideal control of basic. Exclusion criteria were: patients with a history of hip surgery and infectious diseases. On the basis of Anesthesia methods, patients were divided into nerve-block Anesthesia (group A) and waist - hard union Anesthesia (group B); there were 54 patients, including 46 cases of femoral neck fracture, six cases of chemic necrosis of the femoral head, and two cases of congenital hip dysplasia (DDH). Among the 54 patients enrolled in the study, 21 were males and 33 were females. Their ages ranged from 71 to 90 years old; average age was 76.28 ± 4.33 years old. Comorbid diseases included 18 patients with hypertension, 11 with chronic obstructive pulmonary disease, three with coronary heart disease, and 10 with type 2 diabetes mellitus. There were five patients with a history of cerebral infarction and five with malignant tumors. There was no statistically significant difference between the two groups in age, gender composition, or underlying disease ($P > 0.05$).

Pre-operation

Before the operation, all patients were required to control their blood pressure and electrolyte balance, and to control their pre-meal blood glucose under 8.0; postprandial blood glucose was below 10.0. Systolic pressure was maintained below 150 mmHg. Group A had a regular diet; Group B fasted for more than 8 hours, and did not intake water for more than 4 hours. All patients were treated with cefuroxime sodium 1.5 g intravenous drip. Preoperative treatment was identical.

Methods of Anesthesia and Analgesia

After entering the operating room, a vein channel was established in each patient and blood pressure was monitored, along with electrocardiogram, pulse, and oxygen saturation; patients were administered oxygen inhalation by facemask. Group A used a portable color ultrasonic diagnostic instrument (produced by FUJIFILM Sono Site, USA, type M-turbo) for accurate

localization of the lumbar plexus, femoral nerve, and sciatic nerve; they were injected with 0.2% ropivacaine (AstraZeneca Pharmaceutical Co. Ltd., batch number: HAVH, specification 10 ml), 20 ml local infiltration. In group B, traditional lumbar - hard combined Anesthesia was used, and the epidural catheter was left in place to facilitate the maintenance of intraoperative aesthetic drugs. During the operation, continuous colloids and crystal liquid were balanced equally. According to patients' conditions, the authors routinely used drugs to maintain the patients' vital signs.

Operation Method

All included patients were operated on by the same surgeon. The direct anterior approach was used. The proximal femur was exposed by a self-made femoral side hook during the operation; the anterior capsule was maintained. The incision length for all patients was within 10cm.

Post-operation

In group A, patients were allowed to eat and drink as usual after surgery; Patients in group B gradually regained their diet after 6 hours. The remainder of conditions were identical.

Observation Indexes

We recorded the following parameters: [1] patients' starting blood pressure T0, heart rate P0 before in the hospital; blood pressure T1, heart rate P1, blood pressure T2, heart rate P1 before operation; P2 for 1 hour on surgery, at the end of surgery, heart rate T3, blood pressure P3; (2) the blood volume of the operation (ml); intraoperative fluid volume (ml). Pain score was assessed for 6 hours after surgery (the visual analogue score was used to evaluate pain, the highest pain was 10 points, the lowest pain was 0 points). (3) operation duration (min); haemoglobin loss (g/L) before and after surgery; loss of albumin before and after surgery (g/L); postoperative adverse reactions (cases); (4) 24-hour drainage (ml); postoperative time (h); postoperative blood transfusion; length of hospital stay (d).

Statistical Methods

Data were analyzed by SPSS 17.0 software, count data were checked by χ^2 measurement, data were expressed by mean \pm SD, tested by t-test and χ^2 test. $P < 0.05$ was considered to indicate a statistically significant difference.

Results

General Comparison

General information of the patients was compared. It represented that there was no significant difference between these two groups (Table 1).

Group	Cases (number)	Age (years)	Gender (man/female)	High blood pressure (number)	Diabetes (number)	History of cerebral infarction (number)
A	27	75.52±4.80	Aug-19	7	3	2
B	27	75.93±5.02	13/14	13	7	3
t(x ²)		-0.296	0.264	0.158	0.293	1
P		0.769	0.132	0.079	0.147	0.5

Table 1: Comparisons of characteristics between the two groups of patients.

Operation and Related Indexes Comparison

Comparison of blood pressure, heart rate, and blood pressure before and after operation between groups A and B showed no statistically significance ($P > 0.05$) (Table 2).

Index	Groups	Cases	T0	T1	T2	T3
SBP	A	27	133.96±17.59	142.22±3.760	140.44±27.56	131.00±13.63
	B	27	136.96±16.70	144.78±4.42	126.81±24.53	122.11±12.68
P			0.522	0.654	0.039	0.022
DBP	A	27	80.48±2.58	73.67±9.30	78.59±10.50	73.41±9.23
	B	27	79.41±2.23	77.93±13.15	73.19±10.26	68.33±7.45
P			0.769	0.211	0.046	0.039
HR	A	27	79.81±1.82	78.48±11.95	77.63±12.54	74.67±17.15
	B	27	82.26±2.33	86.70±14.01	86.67±14.15	81.89±9.40
P			0.863	0.028	0.018	0.046

Table 2: Comparisons of haemodynamics between the two groups.

There were no statistically significant differences in operation time, intraoperative blood loss, haemoglobin difference before and after surgery, albumin difference, or postoperative drainage volume at 24 hours (Table 3).

Groups	Cases	Time of operation (min)	Amount of bleeding (ml)	Drainage (ml)	Hb difference value (g/L)	Albumin difference value (g/L)
A	27	103.37±46.46	285.93±141.70	102.22±60.98	26.96±10.32	8.19±4.27
B	27	186.93±287.10	312.96±168.47	110.74±53.85	27.44±11.57	8.83±3.48
t(x ²)		-1.474	-0.595	-0.151	-0.531	-0.645
P		0.125	0.557	0.881	0.6	0.525

Table 3: Comparisons of surgical indicators between the two groups.

Two groups of patients with 1-hour time (T2), end of surgical (T3) blood pressure and heart rate showed statistically significant differences ($P < 0.05$) see (Table 2). Postoperative VAS pain score, down time, and hospitalization time between two groups of patients showed statistically significant differences ($P < 0.05$). The incidence of postoperative adverse reactions and number of cases requiring blood transfusion showed no statistically significant differences between the two groups ($P > 0.05$) (Table 4).

Groups	VAS grade	Shimoji time (h)	hospital stay time (d)	Homologous transfusion (Y/N)	complications (Y/N)
A	2.04±0.69	79.11±11.17	13.44±2.23	Oct-17	Jan-26
B	2.50±0.76	94.22±23.93	16.81±5.16	Oct-17	Jul-20
t(x ²)	-2.442	-2.769	-2.774	1	0.05
P	0.022	0.01	0.01	0.611	0.025

Table 4: Comparison of postoperative indexes between the two groups.

Discussion

Total Hip Arthroplasty (THA) has been popularized for nearly 20 years in our country as a mature surgical technique; it is one of the most effective treatments for hip diseases, such as hip fracture, DDH, ONFH, and degenerative hip arthritis [8]. The elderly is inclined to experience hip fracture, also called final fracture after slight injury because of their osteopenia and low bone mineral density [9,10]. THA has a remarkable effect on hip fracture operations for the elderly and has a wide ranges of applications, which brings new hope to elderly patients. However, for elderly patients, the risk of operation is high because they exhibit underlying diseases, poor physical qualifications, and low endurance capacity for the operation. Particularly, they often exhibit internal diseases [11], such as coronary heart disease, pulmonary heart disease, diabetes, and hypertension [12]. Combined Spinal and Epidural Analgesia (CSEA) is applied to THA frequently due to its great anesthetic effect and simple procedures [13]. However, elderly patients have degenerative changes of the spine, including yellow ligament calcification and lateral curvature of the spine, which make posterior epidural puncture more difficult and easily lead to failure of Anesthesia and greatly affect haemodynamics [14]. The effect of nerve block Anesthesia is accurate, haemodynamics are stable, and stress reaction is inactive during operating [15,16]. At the same time, MIS-DAA is characterized by minimal trauma, stable prosthesis, and a high degree of satisfaction from patients; notably, it can decrease trauma and increase the perioperative safety, which is convenient for surgical management and rapid recovery [17,18]. This combination is coincident with two basic measures of ERAS, which are smaller operative wound and lightest trauma and better Anesthesia in order to reduce stress response.

In this study, the ache that most of the patients suffer after THA is from fascia outside, rather than in deeper groin [19]. The ache after THA is mainly from the nerve of the lumbosacral plexus [20]. Therefore, after the nerve of the lumbosacral plexus is blocked, ache is effectively reduced. The lumbar plexus - sciatic nerve block has a rapid effect and can quickly eliminate aches, reducing the dosage of postoperative relief pain medicine [21]. Therefore, in theory, blocking nerves that control muscles in the surgical area can effectively reduce intraoperative and postoperative pain [22]. In addition, optimal pain control can accelerate postoperative recovery, reduce hospitalization time, and reduce postoperative complications, thus increasing patient satisfaction. DAA enters from the natural muscle anatomical gap into the hip joint without any breakage of hip muscle [23,24]. The damage to the muscle

tissue is small, and the postoperative prosthesis has good immediate stability [25,26]. The first day after surgery, patients can walk; long-term stability of the prosthesis is not significantly different from that of other surgical methods. None of the patients included in this study had postoperative dislocation (3-month follow-up). Pogliacomì and similar investigators also found that, from the perspectives of duration of hospitalization, amount of blood transfusion, perioperative complications, prosthesis position, preoperative and postoperative patients with 1 year Harris hip joint function score (HHS), patients who underwent MIS direct lateral approach and MIS-DAA both reported the same satisfaction and incidence of advanced complications; notably, the pain score of patients in the MIS-DAA group was lower [27]. The present study showed that the postoperative VAS pain score of group A was lower than that of group B, and that the postoperative time and length of stay were both shorter in group A than in group B (the difference was statistically significant ($P < 0.05$)); this is likely because the postoperative pain was relieved and postoperative comfort was high, such that patients could begin moving again at an earlier date. Activities to reduce the incidence of complications, such as falling, pneumonia, and deep vein thrombosis, quickly reach the level for discharge, and patients can leave the hospital more rapidly, thus reducing the consumption of medical resources and the medical expenses of patients.

Because of spinal degeneration in the elderly, narrowing of the intervertebral canal space may accelerate the diffusion of local aesthetic drugs, leading to over-Anesthesia, which affects hemodynamic stability [28]. For elderly patients with hypertension, coronary heart disease and other cardiovascular diseases, intraoperative hypotension will directly lead to insufficient myocardial blood supply and even induce myocardial infarction [29]. This study showed that group A exhibited disease-like blood pressure at T2 and T3 more frequently than group B, and heart rate was lower than that of group B, with statistically significant differences ($P < 0.05$). It is suggested that the effect of local nerve block Anesthesia on haemodynamics is less than that of traditional lumbar - hard combined Anesthesia. Patients had lower intraoperative stress response, which is more conducive to the safety of surgery and Anesthesia [30].

Conclusion

In conclusion, elderly patients can achieve Anesthesia similar to lumbar Anesthesia by using peripheral nerve block Anesthesia of the hip joint, with small disturbances to the whole body, providing

a fast and accurate Anesthesia effect; concomitantly, this approach avoids the hard waist Anesthesia response, and is convenient for Anesthesia and nursing care. Combined with MIS-DAA technology, this approach further reduces surgical trauma injury and accelerates postoperative rehabilitation of patients, which produces a very good effect on elderly patients. Limitations of this study are as follows: 1. complete muscle relaxation may not be achieved in young adults and those with muscular development. 2. Nerve block Anesthesia requires expert anaesthesiologists, as it must be performed with ultrasound-guided puncture; 3. Due to the small sample size, some data differences may not be reflected; The patients were followed for a short time, and the long-term effect of hip arthroplasty on the function of prosthesis under Anesthesia with nerve block should be determined by further analysis.

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