Research Paper

Application of Non-Opioids under the Concept of Enhanced Recovery after Surgery under Ultrasound-Guided Iliac Fascia Nerve Block Anesthesia in Elderly Patients with Hip Fracture Surgery

CHEN ZHANG AND QINGQING SHI[1]*

Department of Anesthesiology, Taizhou Traditional Chinese Medicine Hospital, [1]Department of Anesthesiology, Taizhou Municipal Hospital, Taizhou, Zhejiang Province 318000, China

To discuss the application of enhanced recovery after surgery concept in ultrasound-guided iliac fascia nerve block in elderly hip fracture surgery patients and its effect on traumatic stress in patients during perioperative period. Selected 100 elderly patients undergoing hip fracture surgery in our hospital from January 2021 to September 2021. Divided 50 patients of non-opioid ultrasound-guided iliac fascia nerve block anesthesia into observation group and the other 50 patients of opioid (sufentanil) anesthesia into control group. Compared perioperative heart rate and mean arterial pressure indexes of both groups; compared visual analog scale, sedation-agitation scale and mini-mental state examination scores of patients on the 2 d after surgery; compared cortisol, C-reactive protein and interleukin-6 levels in serum of both groups. Compared Harris hip function score, perioperative complications (pressure sores, lower extremity venous thrombosis, lower limbs swelling, lung infection), length of hospital stay and hospitalization expenses of both groups at 3 mo after surgery. Observation group had lower mean arterial pressure and heart rate during spinal canal intubation than control group, which possessed statistical significance ($p<0.05$). On the 1 d after surgery, observation group had higher visual analog scale score than control group ($p>0.05$), but had remarkably lower sedation-agitation scale score than control group ($p<0.05$), and had remarkably higher mini-mental state examination score than control group ($p<0.05$). At 3 mo after surgery, observation group had higher affected hip joint Harris score than control group ($p<0.05$), and postoperative complications rate in observation group (8 %) was remarkably lower than control group (16 %), observation group had remarkably lower hospitalization expenses and length of stay than control group, so the divergence possessed statistical significance ($p<0.05$). Under the concept of enhanced recovery after surgery, non-opioids under ultrasound-guided iliac fascia nerve block anesthesia can better improve hip joint function, reduce postoperative cognitive dysfunction and reduce postoperative complications in geriatric hip fracture surgery. It can remarkably shorten the length of hospitalization and hospitalization expenses. Compared with traditional opioid spinal anesthesia, it can remarkably accelerate the recovery of patients after surgery.

Key words: Non-opioids, arthroplasty, sufentanil, anesthesia, surgery

Hip fracture is one of the most common fracture in the elderly. As the increasing aging of population and more elderly basic diseases, the annual hip fracture rate is also rising year by year[1,2]. In North America, large amounts of evidence shows that early surgical intervention can improve the results[3]. Moreover, in-time hip fracture treatment is a quality standard index for provincial government to evaluate hospital performance[3]. For the elderly, Total Hip Arthroplasty (THA) is a most used surgical method in North America. Plenty of centers have developed standardized nursing approaches to improve the medical quality of patients undergoing hip fracture surgery, achieve earlier rehabilitation and better clinical efficacy, and help reduce the medical costs associated with the increase in the number of operations[4].

Enhanced Recovery After Surgery (ERAS) is proposed based on optimizing the perioperative strategy, using a multidisciplinary method to less patients' surgical trauma and accelerate postoperative recovery[5]. It is reported that different ERAS approaches can reduce the incidence of postoperative complications of colorectal, thoracic and orthopedic surgery, save costs, promote rapid rehabilitation, obtain clinical efficacy

***Address for correspondence**
E-mail: shiqq0516@163.com

and reduce medical payment[6,7]. Regional anesthesia is recommended for ERAS patients, which can provide reliable analgesia. According to relevant literature, it has little interference on hemodynamics[8]. However, for patients receiving THA, spinal anesthesia often leaves a urinary catheter for a long time. In addition, it may weaken the muscle strength of the lower limbs and delay the time to get out of bed[9].

Ultrasound-guided iliac fascia nerve block anesthesia with non-opioids is a combination of opioid-free and multi-mode anesthesia, and high-quality non-opioid block anesthesia can be obtained[10]. At present, the application of ERAS concept in elderly hip fractures is mainly focused on perioperative nursing research and the research of rare anesthesia schemes in ERAS[11,12]. This study provided basis or reference for perioperative diagnosis and treatment of elderly hip fracture patients by exploring the application of ERAS concept in opioid-free ultrasound-guided iliac fascia nerve block in aged hip fracture surgery and its impact on the traumatic stress in patients during perioperative period.

MATERIALS AND METHODS

Clinical information:

Selected 100 aged hip fracture surgery patients in our hospital from January 2021 to September 2021. Divided 50 patients of non-opioid ultrasound-guided iliac fascia nerve block anesthesia into observation group and the other 50 patients of opioid (sufentanil) anesthesia into control group. 36 males and 14 females included in observation group, ages were from 56 y to 76 y old, average were about (63.39±11.64) y old, 11 cases of hypertension and 6 cases of diabetes mellitus. 39 males and 11 females included in control group, ages were from 53 y to 75 y old, average were about (62.75±11.31) y old, 9 cases of hypertension and 8 cases of diabetes mellitus. Age, gender and underlying diseases of both groups possessed no significant difference ($p>0.05$) and can be compared.

Inclusion criteria: The patients had no nervous system diseases such as unconsciousness disorder, mental abnormality and limited cognitive function, and had good cardiopulmonary function; all patients were adults and over 18 y old; the preoperative anesthesia grade of the patients was I~III according to American Society of Anesthesiologists (ASA); the patients and their families understood the situation, agreed and signed the informed consent form; got approval from the ethics committee of the hospital.

Exclusion criteria: The patient belonged to emergency surgery and the patient had renal function impairment before the operation (including those with high blood pressure, diabetes history and long-term disease involving the kidney); patients with severe cardiopulmonary dysfunction; patients with disturbances of blood coagulation; patients with mental disorders; patients with allergy history to fentanyl drugs.

Method:

Treated both groups with combined spinal epidural block, after 15 min intraspinal anesthesia, injected control group with opioid sufentanil 0.1 μg/kg intravenously. Adopted observation group with iliac fascia block under ultrasound guidance before combined spinal epidural anesthesia, punctured with ultrasonic in-plane technology and injected with 30 ml of 0.25 % rocaine hydrochloride. After the anaesthesia operation was completed, adjusted the anesthesia level to below T10 and performed hip fracture operation after the vital signs were stable. In the perioperative period, adopted the traditional diagnosis and treatment of hip fracture to implement routine intervention measures for control group, and adopted ERAS concept of multidisciplinary cooperation to implement intervention measures for observation group.

Observation indicators:

Recorded Heart Rate (HR), Mean Arterial Pressure (MAP) and other indicators of both groups when they entered the operating room, when the spinal canal was intubated, when the operation started (T2), when the operation was 30 min and when the operation ended; recorded Visual Analog Scale (VAS) score on the 2 d after operation to evaluate the perioperative pain degree of both groups, Mini–Mental State Examination (MMSE) score to evaluate postoperative cognitive function and Sedation-Agitation Scale (SAS) score; compared the serum levels Compared Cortisol (COR), C-Reactive Protein (CRP) and Interleukin-6 (IL-6) of both groups; evaluated the hip function according to Harris hip function score 3 mo after operation; recorded the perioperative complications (pressure sores, lower extremity venous thrombosis, lower limbs swelling, lung infection) of both groups and recorded the length of hospital stay and hospitalization expenses of both groups.

Statistical analysis:

Adopted Statistical Package for Social Sciences (SPSS) 26.0 software to analyze all the data in this study. Used mean±standard deviation ($\bar{x}\pm s$) to express quantitative data. The measurement data conformed to normal distribution and adopted independent sample t-test for comparison between both groups. If it did not meet the normal distribution, represented them by M (P25, P75) and used Mann-Whitney U to test, adopted χ^2 to test enumeration data. $p<0.05$ indicates that the divergence possesses statistical significance.

RESULTS AND DISCUSSION

The results showed that HR and MAP of both groups in different times did not change much. It possessed no significant difference between both groups when they entered the operating room, at the beginning of the operation, at 30 min after the operation and at the end of the operation, so it had no statistical significance ($p>0.05$). Observation group possessed remarkably lower HR and MAP values than control group during spinal canal intubation, they were remarkably different, so it possessed statistical significance ($p<0.05$) as shown in Table 1 and Table 2.

Compared COR, IL-6, and CRP levels of both groups before and after surgery, they were no remarkable difference, so it had no statistical significance ($p>0.05$); at 24 h after operation, COR, IL-6 and CRP of both groups increased obviously compared with before operation, but it had no significant difference between both groups, so it possessed no statistical significance ($p>0.05$) as shown in Table 3.

On the 2 d after operation, observation group had higher VAS score than control group and the divergence possessed no statistical significance ($p>0.05$); observation group had remarkably lower SAS score than control group, and the divergence possessed no statistical significance ($p<0.05$); observation group had remarkably higher MMSE score than control group, and the divergence possessed no statistical significance ($p<0.05$); in the 3rd mo after operation, observation group had higher affected hip joint Harris score than control group and the divergence possessed no statistical significance ($p<0.05$), indicating that non-opioids could remarkably reduce the cognitive impairment of patients and did not increase the postoperative pain as shown in Table 4.

The incidence of postoperative complications (pressure sores, lower extremity venous thrombosis, lower limbs swelling, lung infection) in observation group (8 %) was remarkably lower than control group (16 %) and the divergence possessed statistical significance ($p<0.05$), as shown in Table 5.

The average hospital stay in observation group (9.3±2.1) d was remarkably lower than control group (13.4±3.6) d, which possessed statistical significance ($p<0.05$); the hospitalization expenses in observation group (3.8±1.4) million Yuan were remarkably lower than control group (4.7±1.9) million Yuan and the divergence possessed statistical significance ($p<0.05$) as shown in Table 6.

TABLE 1: COMPARISON OF MAP VALUES BETWEEN BOTH GROUPS IN DIFFERENT TIMES [MMHG, M (P25, P75)]

Group	Cases	MAP				
		At the time of entering the operating room	At the time of spinal canal intubation	At the beginning of the operation	At 30 min of the operation	At the end of the operation
Observation group	50	97.38 (94.48, 104.50)	91.58 (87.00, 86.18)	82.18 (87.08, 90.83)	84.50 (81.58, 92.48)	87.18 (82.48, 85.25)
Control group	50	98.50 (92.48, 105.58)	97.83 (94.25, 102.42)	82.50 (87.18, 91.25)	90.00 (82.58, 96.18)	87.50 (82.83, 87.48)
U		346.5	156.19	383.19	395.5	356.5
p		0.942	0	0.573	0.311	0.639

TABLE 2: COMPARISON OF HR BETWEEN BOTH GROUPS IN DIFFERENT TIMES (times/min, $\bar{x}\pm s$)

Group	Cases	HR				
		At the time of entering the operating room	At the time of spinal canal intubation	At the beginning of the operation	At 30 min of the operation	At the end of the operation
Observation	50	74.14±13.07	66.97±9.36	65.80±8.97	66.86±9.36	67.34±9.18
Control	50	70.67±12.51	76.04±9.74	64.95±9.19	66.03±9.04	64.54±8.84
t		1.142	-4.521	1.301	0.811	1.134
p		0.447	0.004	0.223	0.532	0.206

TABLE 3: COMPARISON OF PREOPERATIVE AND POSTOPERATIVE COR, IL-6 AND CRP BETWEEN BOTH GROUPS ($\bar{x}\pm s$)

Group	Cor (ug/l)			IL-6 (pg/ml)			CRP(mg/l)		
	Preoperative	Postoperative	24 h after operation	Preoperative	Postoperative	24 h after operation	Preoperative	Postoperative	24 h after operation
Observation group	157.02±11.93	159.82±11.37	239.87±21.38	25.55±5.91	25.82±3.82	190.26±16.32*	3.54±1.34	3.71±1.37	36.34±10.47
Control group	153.34±10.68	155.71±4.35	234.85±18.37	24.72±4.17	23.98±2.69	189.98±16.59*	3.64±1.39	3.82±1.63	37.03±10.23*
t	0.38	0.31	1.12	0.1	0.12	0.09	0.06	0.05	0.07
p	0.7	0.341	0.565	0.91	0.45	0.82	0.94	0.64	0.73

TABLE 4: COMPARISON OF SAS, MMSE, VAS AND HARRIS SCORES BETWEEN BOTH GROUPS AFTER SURGERY ($\bar{x}\pm s$)

Group	Cases	SAS scores	VAS scores	MMSE scores	Harris scores
		2 d after operation	2 d after operation	2 d after operation	3 mo after operation
Observation group	50	31.19±3.40	5.18±1.39	27.54±1.54	92.75±3.54
Control group	50	35.45±4.43	4.96±1.35	24.93±1.39	89.88±4.76
t		2.57	0.02	2.75	5.79
p		0.02	0.96	0.01	0.002

TABLE 5: COMPARISON OF POSTOPERATIVE COMPLICATIONS BETWEEN BOTH GROUPS

Group	Pressure sores	Lower extremity venous thrombosis	Lower limbs swelling	Lung infection	Total
Observation group	1 (2 %)	0 (42.9 %)	1 (2 %)	2 (4 %)	4 (8 %)
Control group	2 (4 %)	1 (4 %)	2 (4 %)	3 (6 %)	8 (16 %)
χ^2			0.83		
p			0.032		

TABLE 6: COMPARISON OF HOSPITALIZATION EXPENSES AND LENGTH OF STAY BETWEEN BOTH GROUPS

Group	Cases	Length of stay	Hospitalization expenses (million Yuan)
Observation group	50	9.3±2.1	3.8±1.4
Control group	50	13.4±3.6	4.7±1.9
t		2.45	3.57
p		0.005	0.02

The concept of ERAS or fast track surgery was proposed in 1997 by Dr. Henrik Kehlet[13] who is a gastrointestinal surgeon. He won the 2014 American Academy of Anesthesiologists Excellence Research Award for his outstanding contributions to anesthesiology by creating ERAS. Large amounts of studies, including clinical studies, evaluation analysis and meta-analysis, have indicated that compared with regular therapy, ERAS program may shorten the length of hospital stay, postoperative complications rate, hospitalization costs and accelerate the postoperative recovery time of various types of perioperative operations[14,15].

ERAS are an approach that involves multidisciplinary efforts, including surgery, anesthesia, psychology, nutrition and nursing support. The results of ERAS pathway are influenced in many ways and anesthesia is one of them[16]. However, anesthesia has important effects because it affects the postoperative recovery time, patient satisfaction and hospital complications, and it also reduces the incidence of postoperative cognitive dysfunction[17]. In this study, we have developed an ERAS approach which mainly minimized the carryover effects of anesthetics by applying non-opioid drug Roxane hydrochloride to achieve rapid recovery. According to reports, this anesthesia program can promote early recovery without increasing postoperative pain[18]. There are research reports that ERAS has advantages in reducing orthopedic postoperative complications, 30 d mortality, reducing hospital costs and length of stay, but it has no advantage in the 30 d readmission rate[19].

In our study, we discussed the effects of opioids-free and opioids on elderly hip fracture surgery under ultrasound-guided iliac fascia nerve block anesthesia under the concept of ERAS, compared HR and MAP indexes of both groups, and also compared VAS, SAS and MMSE scores of both groups on the 2 d after operation, simultaneously compared serum COR, CRP and IL-6 levels in the perioperative period of both groups, Harris hip function score 3 mo after operation, perioperative complications (pressure sores, lower extremity venous thrombosis, lower limbs swelling, lung infection), length of hospital stay and hospitalization expenses. The study found that observation group had lower MAP and HR than control group during spinal canal intubation, which possessed statistical significance ($p<0.05$). It had no difference in MAP and HR during the rest of the perioperative period. The difference of IL-6, CRP and COR in serum had no statistical significance between both groups. The postoperative complication (pressure sores, lower extremity venous thrombosis, lower limbs swelling, lung infection) rate of observation group (8 %) was remarkably lower than control group (16 %). Observation group had remarkably lower hospitalization expenses and length of stay than control group, and the divergence had no statistical significance

($p<0.05$). The results of the study are consistent with the results of previous studies, which also reflect the key role that the ERAS program plays in the choice of anesthesia surgery methods and drugs. However, this study also has limitations. First, we did not study the optimal clinical dose of non-opioid painkiller Roxane hydrochloride for postoperative hyperalgesia. Single-center cases are still insufficient and multi-center prospective studies are needed to verify the results. The point is that this study did not compare data on the impact of reduced opioid use with non-opioid use on patients' perioperative period and complications. This should be a key consideration when defining the best management of postoperative pain.

In conclusion, this study found that non-opioids under the ERAS concept under ultrasound-guided iliac fascia nerve block anesthesia can better improve hip joint function, reduce postoperative cognitive dysfunction and reduce the postoperative complications rate in aged hip fracture surgery. It can significantly shorten the length of hospitalization and hospitalization expenses. Compared with traditional opioid spinal anesthesia, it can remarkably accelerate the recovery of patients after surgery.

Acknowledgement:

This work was supported by Taizhou science and technology plan projects (21ywa65).

Conflict of interests:

The authors declared no conflict of interest.

REFERENCES

1. Ravi B, Pincus D, Wasserstein D, Govindarajan A, Huang A, Austin PC, *et al.* Association of overlapping surgery with increased risk for complications following hip surgery: A population-based, matched cohort study. JAMA Int Med 2018;178(1):75-83.
2. Ju JB, Zhang PX. Epidemiological characteristics of hip fracture: A single center analysis of 1397 cases. J Pract Orthop 2019;25(7):592-5.
3. Bhandari M, Swiontkowski M. Management of acute hip fracture. N Engl J Med 2017;377(21):2053-62.
4. Griffiths R, Babu S, Dixon P, Freeman N, Hurford D, Kelleher E, *et al.* Guideline for the management of hip fractures 2020: Guideline by the association of anaesthetists. Anaesthesia 2021;76(2):225-37.
5. Faulkner HR, Coopey SB, Sisodia R, Kelly BN, Maurer LR, Ellis D. Does an ERAS protocol reduce postoperative opiate prescribing in plastic surgery? JPRAS Open 2022;31:22-8.
6. Fuchs A, Heinisch PP, Luedi MM, Reid CS. Pain after cardiac surgery: Time to include multimodal pain management concepts in ERAS protocols. J Clin Anesth 2022;76:110583.
7. Kang Y, Liu J, Chen H, Ding W, Chen J, Zhao B, *et al.* Enhanced recovery after surgery (ERAS) in elective intertrochanteric fracture patients result in reduced length of hospital stay (LOS) without compromising functional outcome. J Orthop Surg Res 2019;14(1):209.
8. Batchelor TJ, Rasburn NJ, Abdelnour Berchtold E, Brunelli A, Cerfolio RJ, Gonzalez M, *et al.* Guidelines for enhanced recovery after lung surgery: Recommendations of the enhanced recovery after surgery (ERAS®) Society and the European Society of Thoracic Surgeons (ESTS). Eur J Cardiothorac Surg 2019;55(1):91-115.
9. Kaye AD, Chernobylsky DJ, Thakur P, Siddaiah H, Kaye RJ, Eng LK, *et al.* Dexmedetomidine in enhanced recovery after surgery (ERAS) protocols for postoperative pain. Curr Pain Headache Rep 2020;24(5):21.
10. Kaye AD, Granier AL, Garcia AJ, Carlson SF, Fuller MC, Haroldson AR, *et al.* Non-opioid perioperative pain strategies for the clinician: A narrative review. Pain Ther 2020;9(1):25-39.
11. Zhang YP, Jin JY, Liu DH. Analysis of effect of knowledge, belief and behavior of orthopedic nurses on nursing care of patients undergoing posterior lumbar decompression fusion and internal fixation in enhanced recovery after surgery. Chin J Minim. Invasive Surg 2021;21(2):139-44.
12. Lyu Z, Li T, Wu X. Promoting peri-operative management of senile hip fractures in light of enhanced recovery after surgery. Chin J Orthop Trauma 2018;20(5):451-5.
13. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. Br J Anaesth 1997;78(5):606-17.
14. Rushton S, Parameshwar J, Lim S, Dar O, Callan P, Al Attar N, *et al.* The introduction of a super-urgent heart allocation scheme in the UK: A 2-year review. J Heart Lung Transplant 2020;39(10):1109-17.
15. Smirk AJ, Nicholson JJ, Console YL, Hunt NJ, Herschtal A, Nguyen MN, *et al.* The enhanced recovery after surgery (ERAS) greenie board: A Navy-inspired quality improvement tool. Anaesthesia 2018;73(6):692-702.
16. Jia WD. Multidisciplinary team building in enhanced recovery after surgery. Zhonghua Wai Ke Za Zhi 2018;56(1):14-7.
17. Li Y. Strategy and prospective of enhanced recovery after surgery for esophageal cancer. Zhonghua Wei Chang Wai Ke Za Zhi 2016;19(9):965-70.
18. Na DU, Chenglin GU, Mei YA, Yanli JI, Wei WA, Jie LI, *et al.* Assessing the current status of enhanced recovery after surgery in the usage of web-based survey questionnaires by thoracic surgeons and nurses attending the meeting in Mainland China. Zhongguo Fei Ai Za Zhi 2017;20(3):157-62.
19. Jin M, Haobo Z, Shicai F. Application of the clinical pathway of enhanced recovery after surgery (ERAS) in trauma and orthopedics. J New Med 2021;52(6):454.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms

This article was originally published in a special issue, "Modern Applications in Biomedical Research and Pharmaceutical Sciences" Indian J Pharm Sci 2022:84(3) Spl Issue "213-218"