Pisco Med Publishing

Does PENG-LFCN Block Have Significant Optimization Effect?

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Abstract: **Objective:** To compare the clinical effects of pericapsular hip nerve block (PENG) combined with lateral femoral cutaneous nerve block (LFCN) and hourglass iliac fascial space block (FICB) in total hip replacement (THR) in elderly patients. **Method:** Sixty elderly ASA Ⅱ orⅢ patients of both sexes, aged 65-85 yrs., with BMI 18-25 kg/m^2, were divided into two groups by random number table method: FICB (group F, n=30) and PENG-LFCN (group PL, n=30). FICB with hourglass method was performed under ultrasound guidance in group F, and PENG-LFCN block was performed in group PL. After confirming the efficacy of nerve block， total intravenous anesthesia was carried out to maintain bispectrality index values 40-60.Postoperative sufentanil and tropisetron were used for PCIA. The consumption of propofol ,opioid analgesics during operation，postoperative recovery, and the incidence of quadricep muscle weakness at 1h after surgery，the incidence of adverse reactions and the satisfaction score of postoperative recovery and the occurrence of adverse reactions within 48h after surgery was recorded. **Result:** There were no significant differences in intraoperative medication, postoperative recovery and postoperative adverse reactions between the two groups, but the incidence of postoperative quadriceps muscle weakness in the group PL was less than that in the F group at the same time ($P<0.05$), and the postoperative recovery satisfaction score of the group PL was significantly higher than that of the group F. **Conclusion:** Fewer drugs resulted in higher postoperative recovery satisfaction. PENG-LFCN block is worth promoting.

Keywords: Pericapsular Nerve Group Block of the Hip Joint; Total Hip Replacement Arthroplasty; Aged

The majority of patients with hip replacement are elderly patients. The pain is particularly severe and the stress response is strong within two days after the operation, which not only affects the recovery of patients, but also leads to the increase of heart rate and blood pressure, posing a threat to the safety of elderly patients with cardiovascular diseases. With the application of ultrasound visualization technology, regional nerve block technology has become an important content of multi-mode analgesia due to its advantages of sufficient analgesia and reduction of adverse effects of opioids [1]. FICB is a commonly used analgesic method in hip replacement. Although magnetic resonance imaging showed that the diffusion of local anesthesia after FICB did not cover the obturator nerve, hourglass FICB, as a modified technique , still showed opioid retention and lower postoperative pain scores in patients with hip pain[2].PENG block, as a new local block technique based on hip branch block, can target pain fibers more effectively and have less impact on motor function from the anatomical basis. The effectiveness of early analgesia for hip fracture has been clinically confirmed [3][4]. The purpose of this study was to explore whether PENG -LFCN block has a significant optimization effect compared with FICB for total hip arthroplasty under general anesthesia in elderly patients

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1.Methods

This study has been approved by the hospital ethics Committee and informed consent signed with patients. Sixty elderly patients were selected for primary unilateral total hip arthroplasty, aged 65-80 years, with no gender limitation, BMI 18~ 25 kg/m^2,ASA grade Ⅱ-Ⅲ. There were no verbal communication difficulties, no infectious diseases or nerve injury on the block side, no history of narcotic allergy or mental illness, no serious respiratory diseases, no long-term history of opioid use, and no abnormal coagulation function. The patients were randomly divided into two groups (n=30) by random number table method: FICB group (group F) and PENG-LFCN group (group PL).

After the patients entered the room, a venous fluid route was established, HR ,ECG, SpO2, BIS was routinely monitored, radial artery puncture catheterism was performed under local anesthesia to monitor invasive blood pressure, and hourglass FICB was performed in the group F according to the method in literature [5] : the probe is placed vertically at 1/3 of the inguinal ligament, the midpoint of the probe is above the inguinal ligament, and the probe is moved until the hourglass sign composed of the internal oblique sartorius iliopsoas muscle appears on the screen. Using the in-plane technique, the needle was inserted from the tail to the head, and 30 ml of 0.375% ropivacaine was injected into the gap between iliopsoas fascia and iliopsoas muscle.

Group PL was referred to reference [6]: Ultrasonic probe placed in parallel inguinal ligament, identification of femoral artery and femoral head, the probe is moved until the iliac spine, iliac shame uplift and waist muscle tendon iconic structure appeared, the 0.375% ropivacaine 15mL was injected as the needles are inserted near the waist tendon of the surface , the psoas tendon was held up. Then the probe was moved and placed below the anterior inferior iliac spine (ASIS). The triangular gap between the sartorius and tensor latissimus was scanned, and 0.375% ropivacaine 5 ml was injected into the gap.

General anesthesia was performed 20 min after the block effect was confirmed to be satisfactory. Anesthesia induction: midazolam 0.02mg/kg, sufentanil 0.4μg/kg, etomidate 0.2mg/kg, cisatracurium 0.2mg/kg. After tracheal intubation, the anesthesia machine was connected for mechanical ventilation, ventilation frequency was 12-14 times /min, tidal volume was 6 ~ 8mL /kg, and P_{ET} CO_2 was maintained at 35-45 mmHg. Anesthesia maintenance: Propofol 0.5 ~ 5mg·kg^{-1}·h^{-1} and remifentanil 0.1 ~ 0.50μg·kg^{-1}·min^{-1} were injected intravenously to maintain BIS 40 ~ 60, MAP and HR fluctuated within the normal range, and cisatracurium 0.05mg/kg was injected intravenously to maintain muscle relaxation. When MAP fluctuation exceeded 20% of the base value, sufentanil was injected intravenously with 0.1μg/kg, propofol and remifentanil were stopped after suture. After operation, PCIA was performed to maintain VAS＜4.

Intraoperative dosage of propofol, sufentanil and remifentanil opioids were recorded. The time of postoperative anal exhaust, the time of first underground movement, and the length of postoperative hospital stay were recorded. According to literature [7], the incidence of quadriceps muscle weakness and the occurrence of adverse reactions (such as nausea, vomiting, lower limb deep vein thrombosis, local anesthetic poisoning, nerve injury, infection, etc.) within 48 hours after surgery were recorded. Patients' satisfaction score on postoperative recovery was recorded.

SPSS 25.0 statistical software was used for data analysis. The measurement data of normal distribution was expressed as mean ± standard deviation ($\bar{x}$ ± s). Two independent samples T test was used for comparison between groups. Statistical data were compared using χ^2 test or Fisher's exact probability method, $P < 0.05$ was considered statistically significant.

2. Result

There were no significant differences in gender ratio, age, BMI, operation time, intraoperative blood loss, ASA grade as well as intraoperative dosage of propofol, sufen and remifentanil between the two groups (P>0.05).

There were no significant differences in postoperative anal exhaust time, first ground movement time and postoperative hospital stay between the two groups (P>0.05), but postoperative recovery satisfaction score of group F was lower than group PL (P<0.05).

The incidence of myasthenia in group PL was significantly lower than that in the group F($P<0.05$), and there was no significant difference in the incidence of nausea and vomiting within 48h ($P>0.05$), and no adverse events such as respiratory depression, hematoma, infection and deep vein thrombosis occurred in the group PL and F.

3. Discussion

PENG is a new regional analgesic method with rapid effect and definite intraarticular analgesic effect. According to the study results, intraoperative propofol in both groups There was no significant difference in the amount of opioid analgesics, but the postoperative recovery satisfaction of PL group was significantly higher than that of F group, so it can be considered that PENG combined with LFCN block to perform pre-operative analgesia can more effectively inhibit postoperative peripheral or central sensitization and inhibit pain sensitization.

PENG mainly blocked the sensory nerve of the anterior hip capsule, while potentially preserving motor function [9]. The results confirmed this view: the incidence of muscle weakness in the group PL was significantly lower than that in the group F at 1h after surgery, but there was no significant difference between the two groups in terms of postoperative exhaust time, time of first ground movement and postoperative hospital stay. The reason may be, this study takes a single block, the method of anesthesia drug effect time is limited, although FICB block can reduce the quadriceps muscle, but time is not enough to cause statistical differences between two groups of patients with postoperative recovery .The continuous blocking technique can be used in future studies to compare the two blocking methods.

In addition, under the condition of the same concentration of local anesthetic solution, the dosage of the two groups was 30 ml and 20 ml, respectively. In the group PL, a relatively satisfactory analgesic effect could be achieved with less medication, which greatly reduced the probability of local anesthetic poisoning. This advantage will be more obvious in the double hip arthroplasty. It is believed that when the volume of local anesthesia in PENG block is too large, the upward diffusion of the liquid is still possible to form the blocking effect similar to the lumbar plexus, thus affecting the muscle strength of the quadriceps femor muscle. Therefore, the optimal concentration and volume of local anesthesia for PENG block still need to be further studied.

Above all, general anesthesia downlink elderly hip replacement surgery, single PENG joint LFCN block relative hourglass FICB did not show obvious advantage in postoperative recovery, but relative to the FICB block, small impact on the lower limb muscle strength, local anaesthetics less dosage can achieve higher satisfaction with postoperative recovery, more in line with speed recovery after surgery concept, worth promoting.

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