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INDICATORS OF OPTIMAL SYSTEMIC HEMODYNAMICS IN LOWER LIMB JOINT ARTHROPLASTY IN PATIENTS WITH HIGH ANESTHETIC RISK WITH UNILATERAL SPINAL ANESTHESIA COMBINED WITH UNILATERAL EPIDURAL ANALGESIA

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Abstract:

Regional anesthesia (SA, EA) is often preferred in operations on the lower extremities in order to induce the necessary sensory block with minimal impact on the sympathetic nervous system [184; pp.105-115]. The goal of unilateral SA is to limit the spread of somatic and sympathetic blockade [146; pp. 2379-2402], which provides a number of clinical advantages and, above all, in reducing hemodynamic complications [83; pp. 298-311] and is useful in geriatric patients with a hypodynamic circulation regime with low cardiac output, which are the patients we are studying.

Keywords : Epidural anesthesia, comorbidity index, randomized clinical trial.

PURPOSE OF THE STUDY.

The aim of the study in this group was to study perioperative hemodynamic changes and complications, the efficacy and safety of unilateral SA combined with unilateral epidural anesthesia and analgesia in elderly and senile patients with total cement arthroplasty of the joints of the lower extremities.

MATERIAL AND RESEARCH METHODS.

43 patients operated on under conditions of combined unilateral spinal-epidural anesthesia were studied. Inclusion criteria were: age at least 75 years old with ASA-II-III physical status, Charlson comorbidity index over 5.

All patients in this group underwent cement arthroplasty of the joints of the lower extremities (38 - THA, 5 - TKA) under conditions of combined unilateral SA and unilateral EA. Patients of this group, we carried out a two-level blockade. Initially, an intrathecal puncture was performed and a low dose of 0.5% hyperbaric bupivacaine (5 mg) with 20 μg fentanyl was administered with the patient in the lateral position (below leg operated). Then, in the same position, patients underwent catheterization of the epidural space at the level of L2 - L3.

The adequacy of anesthesia was assessed intraoperatively, and the postoperative period analgesia, its effectiveness was assessed after 6, 24, 48 hours according to VAS at rest and during flexion in the operated joints, while walking.

As part of the concept of multimodal analgesia against the background of EA, all patients in this group received NSAIDs (ketoprofen 200 mg/day). Preoperative preparation of patients in this group did not differ from the previous ones. Pre-infusion in the operating room was carried out with crystalloid-colloidal solutions (25–27 ml/kg) with the obligatory addition of vasopressors (5–7 mg) and corticosteroids (prednisalone 1–2 mg/kg or dexamethasone 0.07 μ/kg) administered with infusion pumps.

The main hemodynamic parameters were recorded every 5 minutes during the first 30 minutes after intrathecal administration of bupivacaine with fentanyl, and then every 10 minutes until the end of the operation.

A feature of patients in this group, as well as the previous one, was the age of patients, in which senile age prevailed with a high comorbidity index of 5 and above and physical status according to ASA - II (62.5%) and III class (37.5%).

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All patients initially had a pronounced pain syndrome associated with the underlying pathology of the joints of the lower limb.

By design, this is a randomized clinical trial conducted after obtaining informed consent from patients. The study included 43 patients hospitalized and operated on at the TMA clinic (Department of Orthopedics and Traumatology and Anesthesia and Resuscitation).

Inclusion criteria were: age at least 75 years, physical status according to ASA-II-III, Charlson comorbidity index of 5 or more.

Exclusion criteria were any contraindications to SA and EA, including patient refusal, coagulopathy, allergy to local anesthetics, baseline hypotension.

RESULTS AND DISCUSSION.

The table below shows the demographics of patients in this group operated under conditions of unilateral combined spinal-epidural anesthesia.

Table 3.21
Demographic and clinical characteristics of patients (n = 43).

Indicators	Values
Age, years	78,2 ± 3,0
Gender, m/f/ n %	17/26
BMI, kg/mg	23,9 ± 1,4
Operation side, r/l, n %	24/19
Comorbidity index Up to 3, n% Up to 4 or more, n%	 19 (47,5) 24 (52,5)
Class ASA: II, n %	18 (35)
III, n %	25 (65)

A feature of patients in this group was elderly and senile age with a high comorbidity index (100%) and physical status ASA II (62.5%) and class III (37.5%).

The most significant concomitant diseases in patients of this group were hypertension, coronary cardiosclerosis suffered by IM (2), chronic myocardial insufficiency, varicose veins of the lower extremities, severe pain syndrome.

The initial values of peripheral blood, hemostasis and their changes during the operation practically did not differ from those in the previous groups. Moderate hypovolemia, hemoconcentration and activation of the blood coagulation system, signs of a systemic inflammatory (aseptic) response to the underlying pathology (dystrophic-degenerative changes in the joints (7), fracture of the femoral neck (5), aseptic necrosis of the femoral head (2) were still noted), rheumatoid arthritis (1) In 30 patients, venous access was peripheral, 13 patients had a central vein catheterized (subclavian vein using Seldinger technique).

Table 3.22
Indicators of systemic hemodynamics in patients of this group at the stages of surgery and after it (n = 43).

Indicators	Stages of study						
	Initial	Beginning	Implantation	End	After 30 mins	After 60 mins	After 120 mins
BP syst, mm Hg	149,9 ± 6,0	136,7±5,3	145,5±5,4	140,7±3,7	132,4±4,1	138,4±4,8	143,4±5,5
BP diasmm.rt.st.	83,4 ± 3,9	80,1±4,4	82,7±3,8	80,7±2,9	76,9±4,3	80,7±5,2	81,2±4,9
SBP mm.Hg.st	105,5 ± 4,3	98,9±4,7	103,6±4,2	100,7±3,4	95,4±4,1	100,0±4,9	102,0±5,2

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Heart rate in min	94,7 ± 4,9	89,4±2,6	82,1±2,6	77,6±2,3	88,9±2,3	88,5±2,7	86,4±4,0
CVP cm water st	6,3 ± 1,7	7,2±0,9	7,1±1,2	8,4±1,3	8,4±1,6	8,9±0,5	9,2±1,0
SPO2, %	92,4 ± 0,9	94,0±1,3	93,7±1,4	92,8±0,9	93,1±1,2	92,6±0,9	92,4±1,3

Note: x – $p < 0,05$ relative to the original values

The presented data demonstrate rather stable indicators of systemic hemodynamics at all stages of the operation and the immediate postoperative period. There was only one episode of some decrease in blood pressure and SBP by the beginning of the operation. However, this episode was short-lived and not statistically significant, and this hypotension was only 8.8% lower than baseline systolic BP values. Diastolic BP and SBP decreased by 4% and 6.3%, respectively ($p>0.05$).

The second episode of lowering blood pressure and SBP was in response to the introduction of 2.5 mg of bupivacaine into the epidural space by 80-90 minutes. operating period, due to the weakening of the sensory block in the operated limb. But here, too, the maximum decrease in blood pressure and SBP was within 11.7%, 7.8% and 9.6%, respectively.

With regard to heart rate, there were no episodes of severe tachycardia - or bradycardia - during the entire study period. During the operation, there was a tendency to increase CVP. However, the CVP indicators remained within the physiological range, which indicates an increase in the return of blood to the heart without an overload reaction from the cardiovascular system.

Pulse oximetry indicators improved somewhat during the operation when oxygen was supplied through the mask, then returned to the original values again.

We analyzed changes in BP and SBP immediately after administration of intrathecal 5 mg bupivacaine with 20 μg fentanyl for 30 min.

Table 3.23
Indicators of systemic hemodynamics after performing unilateral spinal-epidural anesthesia before the operation (n = 43).

Time	BP syst	BP diast	SBP	HR
0	149,9 ± 6,0	83,4 ± 3,9	105,5 ± 4,3	88,7 ± 4,9
5	141,6 ± 5,4	80,1 ± 2,7	100,6 ± 4,9	89,2 ± 5,0
10	136,6 ± 4,7*	78,3 ± 4,2	97,5 ± 3,8	82,5 ± 4,7
15	136,3 ± 4,3*	77,9 ± 3,9	97,3 ± 4,1	78,2 ± 4,0
20	137,7 ± 5,0	78,8 ± 4,1	98,4 ± 4,5	86,4 ± 2,7
25	138,6 ± 3,9	81,2 ± 3,3	100,3 ± 3,7	88,3 ± 4,2
30	137,4 ± 4,8	83,3 ± 4,1	101,3 ± 4,4	86,9 ± 5,1

In general, hemodynamics is relatively stable. In this group, we see one episode of a decrease in blood pressure and SBP associated with the interthecal administration of bupivacaine with fentanyl, in response to which systolic, diastolic blood pressure and SBP decreased by a maximum of 10-15 minutes by 9.3%, 6.6% and 4. 7%, respectively, the decrease by 10-15 minutes of systolic blood pressure was statistically significant, but it did not exceed 10%.

As for the heart rate, its maximum decrease by 15 minutes was 11.9% relative to the 0-value ($p < 0.05$). We attributed this to the action of fentanyl. In no case in this group, we noted arterial hypotension exceeding 20%.

Vascular load in this group was 1869.4 ± 278.4 ml.

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SUMMARY.

In response to intrathecal administration of 5 mg of 0.5% hyperbaric bupivacaine solution with 20 μg of fentanyl, an episode of a decrease in systolic, diastolic and mean blood pressure was noted, but this decrease was in the range of 9.3%, 6.6%, and 4.7%, respectively. In no case in this group, we noted arterial hypotension exceeding 20%.

The second episode of BP and SBP decrease was in response to the introduction of 2.5 mg of 0.5% hyperbaric solution into the epidural space by 80–90 min of the operating period due to the weakening of the sensory block in the operated limb. But here, too, the maximum decrease in systolic, diastolic and mean blood pressure was within 11.7%, 7.8% and 9.6%, respectively. Further monitoring revealed a trend towards an increase in BP syst, BP dias and BP mean, which coincided in time with the implantation of the joint components (80-90 min) by 6.4%, 3.2% and 4.7%, respectively, compared with the previous stage study, which was due to the trauma of this stage and the regression of the sympathetic block against the background of residual sedation of patients. As for heart rate, we did not record episodes of severe tachycardia or bradycardia during the entire study period. The observed hypertension and tachycardia at baseline were due to a greater extent to the psycho-emotional stress response when patients were admitted to the operating room, which was confirmed by an increased level of cortisol in the blood.

In general, the hemodynamic profile of patients at the stages of unilateral spinal-epidural anesthesia at the lumbar level was characterized by stable parameters that did not have significant clinical deviations from baseline values. With the introduction of 2.5 mg of bupivacaine into the epidural space unilaterally, which was carried out in 31 patients (77.5%) due to the weakening of the sensory blockade, in the operated limb after 15-20 minutes, which corresponded to the end of the operation, there was some slight decrease in blood pressure, described above.

PRACTICAL RECOMMENDATIONS.

1. The use of variants of balanced anesthesia based on regional blockades (USA, UEA, unilateral spinal-epidural anesthesia with reduced concentrations of local anesthetics) is justified for anesthetic management of lower limb joint replacement in geriatric patients with high comorbidity and physical status III-IV ASA class. Fentanyl with bupivacaine administered intrathecally in unilateral SA, potentiating bupivacaine leads to an increase in the duration of sensory and motor blocks and prolonged pain relief.

2. The proposed technique of unilateral spinal epidural anesthesia may be the method of choice for lower limb joint replacement in senile patients with a high (≥ 4) Charlson comorbidity index and high anesthetic risk (ASA III).

3. In the stability of hemodynamic parameters at all stages of lower limb joint replacement in patients with unilateral SA combined with epidural analgesia in senile patients, a significant role is played by crystalloid-colloidal pre-infusion (HES 130/4) 5 ml/kg with the addition of 5 - 7 .5 mg of vasopressors (ephedrine and dopamine) and corticosteroids (prednisolone) 0.8 - 1.0 mg / kg of body weight.

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