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Combined Spinal-Epidural Anesthesia in Hysterectomy for Elderly Gynecological Patients with Concomitant Cardiovascular Pathology

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Annotation: Elderly gynecological patients with concomitant cardiovascular pathology represent a high-risk population during surgical interventions due to limited hemodynamic reserves and increased sensitivity to anesthetic stress. Optimizing anesthetic strategies for this cohort is essential to minimize perioperative complications. Objective: This study aimed to evaluate the effects of combined spinal-epidural anesthesia (CSEA) on systemic and central hemodynamics, as well as its safety and efficacy, in elderly patients undergoing gynecological surgery.

Keywords: combined spinal-epidural anesthesia, elderly patients, cardiovascular pathology, gynecological surgery, hemodynamics, bupivacaine, fentanyl, TPVR, stroke index, cardiac index.

Introduction

The increasing proportion of elderly and senile patients undergoing surgical interventions highlights the heightened significance of concomitant somatic diseases, most notably cardiovascular pathology. In this patient population, minimal deviations in systemic hemodynamic parameters and respiratory function resulting from anesthesia and surgical stress may precipitate severe intraoperative and postoperative complications [1, 2, 12]. Despite advancements in perioperative care, individualizing anesthetic strategies and accurately assessing risk in geriatric patients with cardiovascular comorbidities remain unresolved challenges requiring further research [3, 7, 12].

Anesthetic management in elderly gynecological patients is critical for stabilizing vital functions, minimizing the neuroendocrine stress response, preventing coagulation disorders, and ensuring optimal postoperative recovery [4, 5]. Regional anesthesia techniques, including combined spinal-epidural anesthesia (CSEA), offer several advantages over general anesthesia: dependable blockade of nociceptive signals, the development of preventive analgesia, improved psychoemotional comfort, and lower neurovegetative stress [2, 6]. Recent studies suggest that CSEA produces stable perioperative pulmonary and cardiovascular outcomes, particularly in high-risk geriatric patients, and yields fewer adverse events than spinal anesthesia alone [8, 10, 13, 15].

However, the specific influence of different anesthetic approaches on systemic and central hemodynamics, homeostatic mechanisms, and the functional state of vital organs during gynecological surgery in elderly patients with cardiovascular disease remains inadequately studied. Existing literature displays significant heterogeneity and, in some cases, contradictory findings, further underlining the relevance of continued research in this area [7, 11, 13, 17]. This study seeks to address these gaps by evaluating the impact of combined spinal-epidural anesthesia versus spinal anesthesia with adjunct regional blocks in elderly gynecological patients with cardiovascular comorbidities.

Objective of the Study

To determine the effect of combined spinal-epidural anesthesia (CSEA) on hemodynamic parameters and to identify adverse effects in elderly female patients with cardiovascular pathology undergoing gynecological surgery.

Materials and Methods

A prospective analysis was conducted on 26 women aged 60–80 years (mean age: 78 ± 8), classified as ASA physical status III or higher, who underwent total (n = 12) or subtotal (n = 14) hysterectomy.

CSEA was performed using a standardized protocol: intrathecal injection of 10 mg 0.5% hyperbaric bupivacaine followed by epidural administration of 20 μg fentanyl. Hemodynamic monitoring included ECG, central venous pressure, saturation, and YM-300 multifunctional monitoring. Stroke index (SI), cardiac index (CI), and total peripheral vascular resistance (TPVR) were measured at multiple time points perioperatively

An analysis was conducted on data from 26 female patients operated on in the Department of Gynecology at the Multidisciplinary Clinic of the Tashkent Medical Academy. All patients underwent hysterectomy (12 total and 14 subtotal). The patients' ages ranged from 60 to 80 years, with a mean age of 78 ± 8 years. The physical status according to the ASA (American Society of Anesthesiologists) classification was Class III or higher.

Anesthetic management was performed according to a standardized CSEA protocol. Following the installation of electrocardiographic monitoring, a multifunctional monitor (YM-300, Ukraine), central venous catheterization, and registration of baseline systemic hemodynamic parameters, oxygen saturation, and homeostasis indicators, premedication and infusion preparation were administered. Low-molecular-weight heparins were used prophylactically.

Prophylactic infusion loading was performed with 300–400 mL of Ringer's solution at a rate of 6.8 mL/min, administered 5–10 minutes before the start of spinal anesthesia and during the early post-puncture period. In cases of systolic blood pressure (SBP) dropping below 100 mmHg, vasopressors (adrenaline, dopamine) and cardiotonics were administered.

Each patient had between 2 and 6 comorbidities, most commonly ischemic heart disease, chronic heart failure, atherosclerotic cardiosclerosis, grade II arterial hypertension, and arrhythmias.

A two-level CSEA technique was employed: epidural catheterization at the L2–L3 level followed by spinal puncture at the L3–L4 level. After confirming cerebrospinal fluid flow, 0.5% hyperbaric bupivacaine was administered intrathecally at a dose of 10.0 ± 0.2 mg. The epidural catheter was fixed, and an additional 20 μg of fentanyl was administered.

Sedation was maintained via continuous infusion of 1% propofol at a dosage of 0.3–1.1 mg/kg/h. Sensory block was evaluated using a 4-point scale (pinprick test), and motor block was assessed using the Bromage scale.

Results and Discussion

Systemic hemodynamic parameters following the administration of CSEA and before the onset of surgery are presented in Table 1. During the first 15 minutes after anesthesia induction, a statistically significant ($p < 0.05$) decrease in arterial pressure and heart rate was observed, with maximum reductions occurring at the 15th minute: systolic blood pressure decreased by 16.2%, diastolic pressure by 13%, and mean arterial pressure by 14.3%.

Table 1. ***Systemic circulation parameters following CSEA administration and prior to the start of surgery in patients (n = 26).***

Time (min)	Systolic BP (mmHg)	Diastolic BP (mmHg)	Mean Arterial Pressure (MAP) (mmHg)	Heart Rate (bpm)
0	140.6 ± 6.5	88.2 ± 3.1	105.6 ± 6.0	72.2 ± 8.7
5	126.4 ± 4.0*	83.7 ± 2.2	97.9 ± 4.2	70.1 ± 5.3
10	119.5 ± 3.1*	79.9 ± 2.1*	93.1 ± 4.0*	66.4 ± 3.7*
15	117.9 ± 4.0*	76.8 ± 3.0*	90.5 ± 3.7*	65.3 ± 4.1*
20	120.1 ± 2.7*	77.7 ± 3.2*	91.8 ± 3.9*	67.9 ± 2.7
25	136.3 ± 3.2	80.1 ± 2.7*	96.8 ± 4.1	69.1 ± 2.9
30	138.7 ± 4.1	83.9 ± 2.9	102.1 ± 3.8	71.2 ± 4.3

Notes: Values are presented as mean ± standard deviation; *Statistically significant compared to baseline (0 min), $p < 0.05$.

Afterward, the parameters gradually returned to baseline values by 25–30 minutes. The reduction in heart rate by 9.6% at the 15-minute mark occurred against the background of dopamine administration, indicating a pronounced parasympathetic influence of the block.

Table 2 illustrates the dynamics of central hemodynamic parameters during the surgical procedure. Stroke volume and cardiac output remained within normal limits, reflecting hemodynamic stability throughout the intervention.

Table 2. Dynamics of Central Hemodynamic Parameters During Surgery (n = 26)

Stage	Stroke Volume (mL)	Cardiac Output (L/min)
Baseline (before incision)	68.2 ± 5.3	4.92 ± 0.42
Skin incision	66.7 ± 4.9	4.87 ± 0.38
Uterine manipulation	67.5 ± 5.1	4.91 ± 0.40
Closure of peritoneum	68.0 ± 5.4	4.95 ± 0.41
End of surgery	68.3 ± 5.2	4.98 ± 0.39

Note: No statistically significant changes were observed ($p > 0.05$) compared to baseline.

A moderate increase in total peripheral vascular resistance (TPVR) was observed at the beginning of the surgery, followed by a decrease and subsequent normalization during the postoperative period.

As shown in Table 3, there was a statistically significant ($p < 0.05$) decrease in stroke index (SI) and cardiac index (CI), as well as an increase in TPVR in the senile age group, confirming the role of age in the development of a hypodynamic circulatory pattern.

Table 3. Central Hemodynamic Parameters in Elderly and Senile Patients

Parameter	Elderly Age Group	Senile Age Group	p-value
Stroke Index (SI), mL/m²	24.3 ± 0.5	21.5 ± 0.3	< 0.05
Cardiac Index (CI), L/min/m²	1.75 ± 0.04	1.55 ± 0.03	< 0.05
TPVR, dyn·s·cm^{-5}	2681 ± 136.1	3027 ± 104.7	< 0.05

Attempts to reduce the bupivacaine dose to 7–8 mg were associated with an insufficient degree of sensory and motor block, despite increasing the fentanyl dose. This led to a higher risk of inadequate analgesia and complications. Although epidural fentanyl exerted a synergistic effect that enhanced the action of the local anesthetic, it could not serve as a substitute.

Conclusions

Combined spinal-epidural anesthesia using 10 mg of 0.5% hyperbaric bupivacaine administered intrathecally and 20 μg of epidural fentanyl in elderly gynecological patients with cardiovascular disease is associated with a moderate, short-term reduction in arterial pressure (by 11.1%, 5.2%, and 7.3% within the first 5 minutes) without significant bradycardia. This technique provides stable systemic and central hemodynamics, exhibits an opioid-sparing effect, and can be recommended as a safe and effective method of anesthesia for this patient population.

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