

Evaluation of the Efficacy and Safety of Spinal Anesthesia Based on Hyperbaric Bupivacaine Combined with Dexmedetomidine and Ketamine in Gynecological Laparoscopic Surgery

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Background

In gynecology, particularly during laparoscopic surgery, the choice of the optimal anesthetic technique remains a subject of ongoing debate. Currently, general balanced anesthesia with mechanical ventilation is considered the standard approach. However, under conditions of carbon dioxide pneumoperitoneum and the Trendelenburg position, this technique may be associated with adverse hemodynamic changes, including increased afterload and impaired organ perfusion. This is particularly relevant in patients at increased risk of cardiovascular complications, as general anesthesia may contribute to greater perioperative hemodynamic instability. At the same time, neuraxial anesthesia is considered a relatively more physiological technique, imposing less stress on the cardiovascular and respiratory systems. Current evidence supports its safety provided that adequate monitoring and standardized protocols are implemented.

Objective

To evaluate the efficacy and safety of spinal anesthesia during gynecological laparoscopic surgery.

Materials and Methods

The study included 620 patients who underwent elective and emergency laparoscopic gynecological procedures. The patients' age ranged from 19 to 65 years, and their body mass index (BMI) ranged from 18.5 to 34.9 kg/m².

The main indications for surgical treatment included chronic inflammatory diseases of the uterine appendages, benign neoplasms of the uterus and ovaries, as well as emergency conditions such as ectopic pregnancy and ovarian apoplexy.

The following laparoscopic procedures were performed: laparoscopic cystectomy, tubotomy, salpingectomy, oophorectomy, and hysterectomy. All patients were classified as ASA physical status I–II. Preoperative preparation included elastic compression of the lower extremities and administration of H₂-receptor blockers. Premedication consisted of intramuscular midazolam administered 30 minutes before surgery. Spinal anesthesia was performed at the L3–L4 intervertebral level using 0.5% hyperbaric bupivacaine (Bupivacaine, Longocaine Heavy) at a standard dose. Spontaneous ventilation was maintained throughout the procedure, with supplemental oxygen administered via nasal insufflation. To reduce psychological and positional discomfort, controlled sedation with dexmedetomidine (Kvanadex) at a dose of 0.5–1.0 µg/kg was used. Comprehensive monitoring was performed, including assessment of: central hemodynamic parameters, including echocardiographic assessment; pulse oximetry; acid–base status; blood gas parameters; serum electrolytes; lactate levels; hematocrit. Blood gas analysis and the assessment of major metabolic parameters were performed using a UCARE6000 Wondfo (Rain Sen Da). Fluid therapy was administered using crystalloid solutions at a rate of 10–12 mL/kg/h, including 0.9% sodium chloride solution, Ringer's solution, or Reosorbilact.

Results and Discussion

Following spinal anesthesia, a tendency toward a moderate decrease in mean arterial pressure (MAP), cardiac output (CO), and systemic vascular resistance (SVR) was observed. After creation of pneumoperitoneum and placement of the patients in the Trendelenburg position, no significant hemodynamic changes were observed; only a slight reduction in systemic vascular resistance persisted. Following completion of surgery and release of the pneumoperitoneum, hemodynamic parameters returned to baseline values. Cardiac output remained stable throughout the surgical procedure. Acid–base status and blood gas parameters remained generally stable. Following the establishment of pneumoperitoneum and placement in the Trendelenburg position, moderate respiratory alkalosis and metabolic acidosis without an increased anion gap were observed. During the early postoperative period, there was a significant reduction in the need for opioid analgesics and nonsteroidal anti-inflammatory drugs (NSAIDs) for postoperative pain management.

Conclusion

Spinal anesthesia with preserved spontaneous ventilation provides a stable hemodynamic profile during gynecological laparoscopic surgery. Neuraxial anesthesia may reduce the adverse cardiovascular effects associated with pneumoperitoneum and the Trendelenburg position. 0.5% hyperbaric bupivacaine provides an adequate level of surgical anesthesia for procedures lasting up to 2.5 hours. Controlled sedation with dexmedetomidine does not have a significant adverse effect on spontaneous respiration or acid–base status.

Age over 45 years should be considered a risk factor for the development of perioperative cardiovascular complications.