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Robotic-Assisted Laparoscopic Prostatectomy under Thoracic Spinal Anesthesia: An Effective Alternative

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1. Abstract

This case report describes a successful use of Thoracic Spinal Anesthesia (TSA) for a 74-year-old patient undergoing Robotic-Assisted Laparoscopic Prostatectomy (RALP). The patient was in good health with an ASA I status and had a mixture of hyperbaric, hypobaric, and adjunctive anesthetic agents, including atropine, dexmedetomidine, and dexamethasone, injected at the T7-T8 level. The patient achieved sufficient anesthesia for the entire surgical procedure with associated sedation, spontaneous breathing, intense postoperative pain control without residual motor blockade. The surgical incision was performed 20 minutes after the spinal puncture, and the patient did not have any reaction. The patient achieved a wakeful sedation after 10 minutes. The robot was used for prostate removal, followed by hemostasis and urethral anastomosis. The console time was 80 minutes. At the end of intervention, the patient had no perception of what occurred. Early feeding, bowel movements and mobilitazion were observed. The analgesic effect prolonged until the following day.

2. Introduction

Robotic-assisted laparoscopic prostatectomy (RALP) is typically performed under general anesthesia [1,2]. However, thoracic spinal anesthesia (TSA) may provide a suitable anesthetic plan for the surgeon while also being comfortable for the patient, with the known benefits of neuraxial anesthesia with spontaneous breathing [3-6]. We performed thoracic spinal anesthesia in an American Society of Anesthesiologists (ASA) physical status I patient by injecting a mixture of hyperbaric, hypobaric, and adjunctive anesthetic agents, including atropine, dexmedetomidine, and dexamethasone, at the T7-T8 level, leading to sufficient anesthesia from C3/C4 to S2 for the entire surgical procedure with associated sedation, spontaneous breathing, intense postoperative pain control without residual motor blockade.

3. Case Report

A 74-year-old man (60 kg, 168 cm), in good health with an ASA I status was candidate for RALP due to prostate-related issues. After obtaining informed consent from the patient regarding the chosen technique, the patient was transferred to the surgical room where an IV access (18G) was established, a prophylactic antibiotic infusion (cefazolin 2g and omeprazole 40mg) was administered, and a premedication with intravenous midazolam (2mg) was performed. The patient was then placed in a sitting position under non-invasive monitoring with a heart rate (HR) of 75 bpm, non-invasive blood pressure (NIBP) of 140/78, and O2 saturation (SaO2) of 98%. The puncture site was identified at the T7-T8 space, and a 25-gauge Quincke needle was used to puncture the dura mater until clear cerebrospinal fluid was obtained. Into separate syringes, hyperbaric bupivacaine 5mg diluted to 0.25% along with atropine 0.1mg, dexmedetomidine 6mcg, dexamethasone 3mg, and ropivacaine 12mg diluted to 0.3% with sterile water to achieve a hypobaric mixture, were then injected.

After the procedure, the patient was repositioned supine, and a fluid preloading of 200 ml of lactated Ringer's solution was initiated to counteract hypotensive events. Hypotension was defined as a systolic blood pressure less than 90 mmHg or a decrease of

more than 20% compared to baseline values, while bradycardia was defined as a heart rate less than 50 bpm. Within 4 minutes, the anesthesia level considered optimal was achieved, with a positive pinprick from S2 to C4. The patient showed a decrease in blood pressure to 100 mmHg systolic with a slowing of the heart rate to 55 bpm without the need for inotropic support.

The patient was then transferred to the operating room to begin the surgical procedure. He achieved a wakeful sedation after 10 minutes. The patient's haemodynamic parameters maintained stable without any further fluid infusion. Any respiratory discomfort was reported. A hoarse voice was mentioned, likely due to the reduced ability to force breaths in presence of intercostal muscles paralysis. No episodes of nausea or vomiting occurred. Despite an ambient air SaO2 of 95%, a Venturi ventimask was applied with an FiO2 of 35%, achieving an SaO2 of 98% that remained stable throughout the surgical procedure.

The surgical incision was performed 20 minutes after the spinal puncture, and the patient did not have any reaction. After the placement of an 8mm trocar in the umbilicus, pneumoperitoneum was induced with 8-12 mmHg pressure, and the surgeon judged the abdominal muscle relaxation and operating room to be adequate. The patient was positioned in Trendelenburg at 28° without any discomfort. The robot (Da Vinci II) was then docked, and the prostate removal was initiated, followed by hemostasis and urethral anastomosis. The console time was 80 minutes, after which the robot was detached, the patient was returned to a supine position, trocars and organs were removed, and a drainage tube was inserted. The incisions were closed, and the surgical field was cleaned, with a total duration of 120 minutes.

4. Observations

The patient did not show any hemodynamic changes and maintained spontaneous breathing with stable SaO2 at 98%, a respiratory rate of 14 breaths per minute, blood pressure between 90-105 mmHg, and a heart rate between 50-58 bpm. At the end of the procedure, the patient was awakened with verbal command, had a VAS score of 0, and did not experience any respiratory discomfort. After 30 minutes of monitoring in the recovery room, the patient was transferred to the ward with a VAS score of 0, mild hypoesthesia in the lower extremities without motor blockade, a GCS score of 15, and was satisfied. Hemodynamic parameters were stable with an SaO2 of 97% ambient air and an Aldrete score of 9, with a total fluid infusion of 400 ml of lactated Ringer's solution.

The patient was able to consume solid and liquid foods 8 hours after the end of the procedure without experiencing any nausea or vomiting and was mobilized actively. The patient reported a VAS score of 0 throughout the night, but on the following day, paracetamol 1000 mg was requested twice due to a VAS score of 2/3. The surgical drainage tube was removed the next day, and he was discharged from the hospital after 48 hours.

5. Discussion

Spinal anesthesia is utilized in videolaparoscopic surgery that requires pneumoperitoneum and non-physiological postures to improve organ exposure without any discomfort to the patient [3-5]. Thoracic spinal anesthesia in surgery with pneumoperitoneum must provide sensory coverage that reaches up to the C4/C5 roots to cover the painful afference caused by diaphragmatic distension, which can evoke shoulder pain [3]. In RALP surgery, lumbar and sacral roots must also be covered by spinal anesthesia to manage pain caused by prostate removal and urethral anastomosis [3-5]. The sensory block up to the cervical metamers, although it may result in a reduction of ventilatory capacity due to intercostal muscle blockage, still preserves the innervation capacity of the phrenic nerve, ensuring adequate spontaneous ventilation [3-6].

In the present case, we assessed the feasibility of thoracic spinal anesthesia in RALP using a single-shot spinal injection of anesthetics with different baricities to ensure sufficient coverage. Adjuvants were also utilized to provide necessary sedation for patient comfort and prolong the duration of the injected anesthetics. RALP involves an extreme Trendelenburg position, which we tested to be well-tolerated by the patient without discomfort, respiratory distress, or resentment. The patient's ventilatory capacity remained valid and stable throughout the entire procedure without the need for any assistance other than oxygen via mask. At the end of the intervention, the patient had no perception of what had occurred but expressed satisfaction with the experience. The analgesic effect was prolonged until the following day thanks to the utilization of adjuvants, minimizing the need for intravenous analgesics and improving the patient's recovery quality. On the same evening, the patient could stand and mobilize, consume food without experiencing nausea or vomiting, and had bowel movements after 12 hours.

6. Conclusions

Thoracic spinal anesthesia proved to be a suitable anesthesiological technique for safely conducting RALP, with ideal surgical conditions and patient satisfaction achieved. This anesthesiological procedure also allows for all the benefits of regional anesthesia in RALP, such as early feeding, mobilization, bowel movements, prolonged opioid-sparing analgesia, and reduction of surgical stress, avoiding complications that may arise from general anesthesia with orotracheal intubation and mechanical ventilation.

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