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Hypobaric Anesthesia. It Is the Great Forgotten

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ABSTRACT

Hip fracture is a common orthopedic pathology in the elderly; Surgery is the generally accepted treatment for this. Isobar and hyper bar anesthesia are usually the most commonly used techniques for this, but these can hemodynamically destabilize older patients with previously compromised cardiac function. On the other hand, hypobaric anesthesia allows us a much more stable anesthetic management in this type of patient.

We present the anesthetic management in two patients who underwent hip fracture surgery, both with severe aortic valve stenosis. The choice of spinal anesthesia with a hypobaric solution, provided hemodynamic stability and optimal conditions for the surgical procedure.

Keywords: Hyperbaric Anesthesia, Surgery, Techniques

INTRODUCTION

The choice of anesthesia technique has a significant impact on perioperative outcomes and it can therefore, be seen as an important component in patient care [1]. General and regional anesthesia are possible for hip fracture management [2] the latter being the most commonly performed at the present time with iso and hyperbaric local anesthetic solutions [3]. However, hypobaric spinal anesthesia is barely used today, mainly because the dilution must get prepared at the bedside by mixing isobaric solutions with distilled water. A small change in density can influence the spread of the local anesthetic. The cephalad spread of the dilution is the main complication. On the other hand, it provides us great hemodynamic stability, an essential condition for many of our patients [4].

We present the anesthetic management in two patients who underwent hip fracture surgery, both with severe aortic valve stenosis. The choice of spinal anesthesia with a hypobaric solution, provided hemodynamic stability and optimal conditions for the surgical procedure.

1º CLINICAL CASE

A 79-year-old woman with a left per trochanteric fracture was to be treated surgically by gamma nail osteosynthesis. She had a personal history of hypertension, diabetes mellitus type 2, dyslipemia, chronic renal failure, permanent atrial fibrillation (AF), no allergies. She had undergone surgery for aortic valve replacement by bioprothesis in 2017.

Since then, he had been monitored for severe aortic valve stenosis of the bioprosthesis. In the echocardiogram she had increased gradients, with a valve area of 0.8 cm^2, preserved left ventricular ejection fraction (LVEF), Pulmonary hypertension (PHT) of 50 mmHg. Coronary angiography showed no significant lesions. She was pending valve surgery by Transcater Aortic Valve Replacement (TAVR).

She had also undergone five years prior, a hemiglossectomy, mandibulectomy and bilateral lymph node excision and reconstruction with the need for tracheostomy (- which was now closed-) and posterior radiotherapy treatment. We examined difficult airway predictors: Mallampati IV was present, interdental distance of 2.5 centimeters (cm), thyromental distance less than 6.5 cm; which predicted a high probability of difficult laryngoscopy and intubation.

On treatment with acenocoumarol, furosemide 40 mg, Xigduo (metformin/dapagliflozin) 5/1000, esomeprazole,

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Ferroglycine sulfate 100 mg, nebivolol, candesartan, simvastatin/ezetimibe.

Blood test: Hemoglobin 10 g/dl, platelets 235000, International Normalized Ratio (INR) 2.8, activated partial prothrombin time (aPTT) 31 seconds (sec), glycemia 177mg/dl, creatinine 1.24, normal ions. Given the coagulation alteration due to the intake of acenocoumarol, the surgery was postponed for 48 h. During this time, we optimized the patient with our hospital Patient Blood Management (PBM) program. We administered 1 gram of intravenous iron, vitamin B12 intramuscular (IM), folic acid. To manage coagulation parameters, we administered vitamin K.

The day of the intervention, the patient had a Hb of 8.5 g/dl, so we transfused one pack of red blood cells prior to surgery.

2º CLINICAL CASE

An 88-year-old woman presented with a left sub capital femur fracture. She was to undergo partial hip prosthesis surgery. The patient had a history of hypertension, chronic venous insufficiency with episodes of deep vein thrombosis (DVT), non-anticoagulated atrial fibrillation. Severe aortic valve stenosis (area of 0.7 cm2), dyspnea with minimal physical activity (NYHA III) and severe cognitive impairment. She was prior ruled out for programmed surgery.

Blood test showed: Hemoglobin (Hb) 11.4 g/dL; 142,000 platelets; INR 1.3; prothrombin activity AP 87%, creatinine 1.6 mg/dL; estimated glomerular filtration rate (CKD) 30.42 mL/min/1.73m2; Iron 67, ferritin 343, ions in range. She was optimized with 1gram intravenous iron.

In the first case, due to the history of VAD, we performed spinal anesthesia.

In the second case, we opted for a combined anesthesia technique (spinal - epidural).

In both cases, prior to the intervention, we performed an ultrasound-guided femoral and femorocutaneous block together with neurostimulation administering mepivacaine 1.5% + ropivacaine 0.375% (10 + 20 ml) divided into 4+3 for FC and the rest for femoral. After standard monitoring (EKG, pulse oximetry and NIBP) in the operating room, spinal anesthesia was performed with 4 mg hypobaric bupivacaine. With the patient in decubitus lateral position with the affected leg above we punctured L3-L4 and administered the preferred solution. The patient remained in this position for 5 min following the procedure. The solution was prepared with 1 ml of 0.5% isobaric bupivacaine (5mg) + 4 ml of sterile water (5mg bupivacaine/5ml) We obtain bupivacaine 0.1%. After this we discard 1 ml, obtaining a total volume of 4 ml.

The combined technique involves intentional subarachnoid block and the placement of an epidural catheter that provides the possibility of prolonging the block without having to perform general anesthesia with the patient in a lateral position. With the patient in this lateral position, we placed the epidural in the same L3-L4 interspinous space. We used a water loss of resistance technique. The space was located at 4.5 cm from the skin. After, we performed the dural puncture (needle through needle) with 27G pencil tip needle, administering the 4ml of bupivacaine 0.1%. And finally, we placed the epidural catheter.

In both cases, a phenylephrine infusion at 0.7 mcg/kg/min was administered prophylactically, without the need for supplemental boluses or any other vasoactive drugs. The 30- and 60-min surgery went off without incident. Our patients remained hemodynamically stable in the immediate postoperative period in URPA.

DISCUSSION

Hip fracture is a serious pathology that mainly affects elderly patients. The prognosis of this disease depends on comorbidities and the quality of perioperative care, as well as the speed of intervention [5]. Postoperative morbidity and mortality are significantly associated with the presence of preoperative anemia, so it is important to detect it and treat it (we use our PBM program) in order to reduce transfusions, its costs and its complications [6].

Perioperative hemodynamic instability is related to the cardiovascular repercussions of neuraxial block and patient compensation mechanisms, which are often altered by aging and comorbidities. A patient with severe aortic stenosis (AS) undergoing a neuraxial block has multiple complications that anesthesiologists should consider, including severe hypotension, ischemic heart disease, and cerebral hypoperfusion [7]. In general, these patients are the exception to neuraxial techniques being the first call, but in some cases, general anesthesia (GA) may present more risks, such as in the case of a known difficult airway.

Hyperbaric, isobaric, and hypobaric local anesthetic (LA) preparations have been used to perform a subarachnoid block. The hyperbaric solution is the most commonly used [8]. The use of hypobaric and hyperbaric solutions presents with a higher frequency of unilateral anesthesia. Unilateral spinal anesthesia is feasible with the use of low doses of local anesthetic, with a slow rate of infusion and placing the patient in lateral decubitus as this facilitates unilateral distribution in spinal anesthesia [9].

The increased interest of unilateral spinal anesthesia is mainly due to the hemodynamic benefits, through the reduction of sympathetic block, in addition to the reduction of complications such as urinary retention. It also avoids unnecessary motor block of the non-operated side, decreases the chances of venous thrombosis, promotes early ambulation and improves patient satisfaction. Furthermore, if the hypobaric solution is chosen, patients do not need to

lie on the fractured limb, eliminating the pain the position associates with.

CONCLUSION

The choice of an appropriate anesthetic technique for patients with severe AD should be based on individualized assessments considering the cardiac condition based on echocardiography findings, the type of surgery, the patient's position, and the functional capacity of the patients.

Hypobaric spinal anesthesia is a good option for unilateral lower limb fracture surgeries. It produces reliable sensory and motor block with excellent hemodynamic stability and postoperative analgesia.

4 mg bupivacaine in a volume of 4 ml of sterile water (Bupivacaine 0.1%) is safe and effective for hip fracture, minimizing the consequences of a higher dose.

Lateral decubitus puncture, with the limb affected above, along with latency of 5 to 10 min prior to surgical incision are essential for a successful technique.

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