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SCIENTIFIC ARTICLE - CASE REPORT

ANESTHESIA IN CYTOREDUCTIVE SURGERY COMBINED WITH HYPERTHERMIC INTRAPERITONEAL CHEMOTHERAPY: A CASE REPORT

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ABSTRACT

Cytoreductive surgery (CRS) combined with hyperthermic intraperitoneal chemotherapy (HIPEC) has become an important approach in the treatment of several neoplasms with peritoneal dissemination. CRS is based on the excision of all macroscopic peritoneal metastatic lesions, while HIPEC is based on the elimination of circulating tumor cells and peritoneal micrometastases invisible to the naked eye. In this context, the clinical case presented involves a 41-year-old female patient who underwent CRS and HIPEC for the treatment of advanced gastric cancer with peritoneal carcinomatosis. Her anesthesia involved total intravenous general anesthesia associated with thoracic epidural, with fluid management guided by ultrasound parameters and management of adverse events, proving effective for the surgical and chemotherapy approach in question.

Keywords: Anesthesia general, Anesthesia epidural, Cytoreduction surgical procedures, Hyperthermic intraperitoneal chemotherapy, Peritoneal neoplasms.

INTRODUCTION

Cytoreductive surgery (CRS), with or without hyperthermic intraperitoneal chemotherapy (HIPEC), has become a cornerstone in the treatment of various neoplasms with peritoneal dissemination.[1] Currently, CRS/HIPEC represents a paradigm shift in the management of patients with peritoneal malignancies, improving prognosis in appendiceal, colorectal, ovarian tumors, and peritoneal mesothelioma.[2]

The fundamental principle of CRS lies in the complete excision of all macroscopic peritoneal metastatic lesions, often requiring extensive multivisceral resections within the abdominal cavity. This procedure aims to remove the primary tumor, tumor implants, and affected areas to reduce the tumor burden and enhance the efficacy of subsequent therapy.[3]

HIPEC, in turn, targets the eradication of circulating tumor cells and peritoneal micrometastases that are not visible to the naked eye. This therapeutic modality consists of the intraperitoneal administration of high-concentration, heated chemotherapeutic agents, immediately after surgical resection and

prior to reconstruction of the gastrointestinal tract.[4] The rationale for hyperthermia is based on the differential susceptibility of malignant cells to heat, resulting in selective destruction within the range of 41 to 43°C. Moreover, the microcirculation in many malignant tumors exhibits complete vascular stasis in response to hyperthermia. The synergy between heat and cytotoxic agents increases cytotoxicity by enhancing drug absorption through increased cell membrane permeability.[5]

The multimodal nature of these procedures for the treatment of abdominal neoplasms may induce significant tissue trauma, with subsequent inflammation and a risk of serious adverse effects reported in up to 51% of cases. Therefore, the implementation of specialized perioperative care is imperative.[6]

In this context, this article presents a case report of the anesthetic management of a patient who underwent CRS combined with HIPEC for the treatment of an intra-abdominal malignancy.

CASE REPORT

The patient is a 41-year-old female, weighing 60 kilograms and measuring 1.70 meters in height, with a positive family history of intestinal cancer and a personal diagnosis of advanced gastric cancer with peritoneal carcinomatosis. She has major depressive disorder and insomnia, treated with desvenlafaxine 100 mg/day and quetiapine 25 mg/day. She also has a history of cesarean section, abdominoplasty, exploratory laparoscopy, and port-a-cath implantation, with no previous anesthetic complications.

During the pre-anesthetic consultation, laboratory tests, electrocardiogram, and echocardiogram were normal. In addition, she was classified as low surgical risk according to cardiology assessment.

Upon arrival in the operating room, the patient underwent monitoring with invasive blood pressure, central venous pressure (CVP), cardioscopy, thermometry, capnography, and depth of anesthesia monitoring. Sedation was initiated with 5 mg of midazolam, followed by epidural puncture at the T8–T9 level using an 18G Tuohy needle, with insertion of an 18G epidural catheter, advanced 5 cm beyond the puncture site.

Subsequently, total intravenous general anesthesia (TIVA) was induced with propofol 150 mg, sufentanil 20 mcg, and rocuronium 50 mg. Direct laryngoscopy (Cormack-Lehane grade 1) was performed, followed by orotracheal intubation with a 7.5 mm tube. Anesthesia was maintained with target-controlled infusion (TCI) of propofol, and an epidural infusion containing ropivacaine 150 mg, fentanyl 100 mcg, and clonidine 150 mcg.

Adjuvant medications included: cefazolin 3 g, metronidazole 1000 mg, dexamethasone 10 mg, dipyrone 4 g, ondansetron 8 mg, parecoxib 40 mg, pantoprazole 40 mg, vitamin C 2 g, and vitamin B complex.

Intraoperatively, peritoneal tumor implants smaller than 5 mm were observed in the cul-de-sac, pelvic-vesical peritoneum, and pancreatic capsule, along with neoplastic involvement of the gastric antrum and body. The surgical procedures performed included total hysterectomy with adnexectomy, rectosigmoidectomy, total gastrectomy with lymphadenectomy, and pelvic peritonectomy.

Following cytoreductive surgery, HIPEC was performed using 5% dextrose solution and oxaliplatin, infused at 42°C for 60 minutes. At the end of the procedure, the HIPEC solution was drained after reopening the abdominal cavity and rinsing with normal saline.

During surgery, fluid resuscitation with crystalloids was guided by fluid responsiveness assessment. Due to the ease of anatomical access without interfering with the surgical field, carotid peak velocity variation was evaluated using pulsed Doppler ultrasound. This assessment was performed after each 1000 ml infusion of warmed lactated Ringer's solution, totaling 7000 ml administered.

During the HIPEC phase, the patient developed hyperglycemia, with wide glycemic variability, requiring continuous intravenous insulin infusion. She also experienced an episode of hypotension, which required low-dose norepinephrine support.

At the end of the procedure, the patient was extubated in the operating room and transferred to the intensive care unit (ICU) with a mean arterial pressure (MAP) of 80 mmHg, CVP of 3 mmHg, and norepinephrine infusion at 0.08 mcg/kg/min. Bedside lung ultrasound (POCUS) showed no signs of congestion, with inferior vena cava diameter less than 2 cm and capillary refill time of 2 seconds (Figure 1).

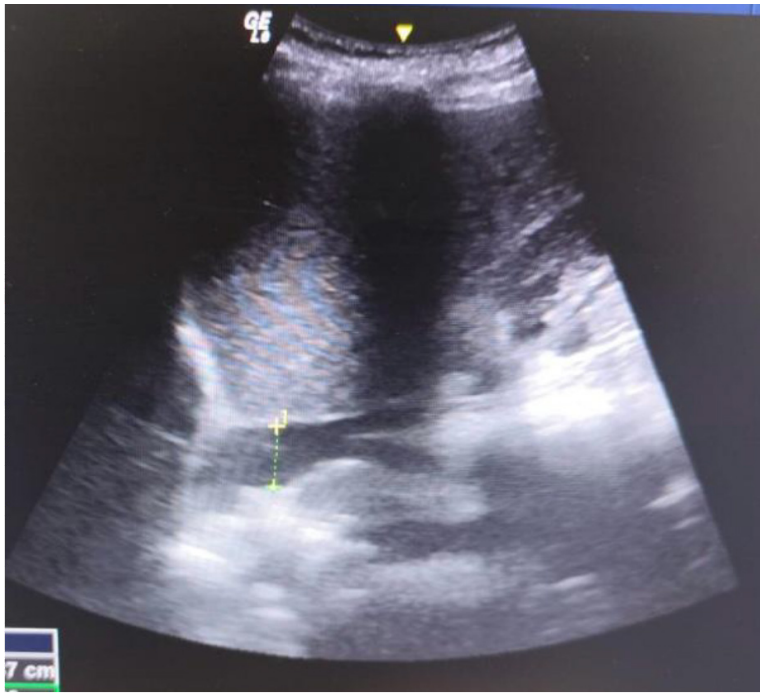

Figure 1. Inferior vena cava ultrasound of the patient in the case, showing a diameter of 1.87 cm

During the first 48 hours of the postoperative period, the patient received an infusion of 0.2% ropivacaine and fentanyl via epidural catheter while in the ICU. During daily evaluations by the anesthesiology team, the patient showed no motor block and reported only palpation-induced pain with an intensity of 3/10 during the first 24 hours, with no further complaints thereafter.

DISCUSSION

Peritoneal carcinomatosis (PC), characterized by the dissemination and implantation of neoplastic cells within the peritoneal cavity, is a common complication of primary malignancies originating in intraperitoneal organs. Disease progression involves invasion of the serosal surface of the primary organ, dissemination of tumor cells, followed by cellular proliferation and neovascularization, resulting in the formation of tumor nodules. This condition is associated with high morbidity and mortality and is observed in 75% of ovarian cancers, 5–10% of colorectal tumors, and 14% of gastric cancers, particularly those arising from gastrointestinal and gynecological tumors.[7]

The implementation of Enhanced Recovery After Surgery (ERAS) protocols is essential in the perioperative management of patients undergoing major procedures such as CRS and HIPEC. These protocols aim to modulate the postoperative metabolic and inflammatory response, optimize care, and consequently reduce complications, length of hospital stay, and costs. Strict adherence to ERAS guidelines has been shown to positively impact clinical outcomes.[8]

Preoperative assessment is a critical component of ERAS protocols for major oncological and abdominal surgeries. Its primary goal is to evaluate the patient's clinical condition, determine the ability to tolerate anesthesia and surgery, mitigate perioperative risks, and prepare the patient for surgery.[9] Cardiovascular evaluation, in particular, is of paramount importance. Patients with reduced cardiac reserve, a history of heart failure, or chemotherapy-induced cardiotoxicity may require additional tests such as echocardiography or stress testing for optimal preoperative planning. In the present case, the patient had normal cardiac function on echocardiography.[10]

Regarding the choice of anesthetic technique, although no approach has demonstrated clear superiority for CRS ± HIPEC, evidence suggests that total intravenous anesthesia (TIVA) may be associated with better long-term outcomes in oncologic surgery. Additionally, TIVA has been shown to reduce the incidence of postoperative nausea and vomiting (PONV) in high-risk groups, particularly in the early postoperative period, compared to inhalational anesthesia.[11] Epidural analgesia, in turn, provides excellent pain control in major laparotomies and may reduce pulmonary complications. Prolonged thoracic epidural analgesia (beyond 72 hours) has been investigated for its potential contribution to disease-free survival and overall survival.[12]

Intraoperative glycemic control is an essential measure to minimize postoperative morbidity and mortality in patients undergoing CRS and HIPEC. Factors related to CRS (surgical stress, fasting, fluid administration) and to HIPEC (hyperthermia, chemotherapy, intraperitoneal carrier solutions) contribute to glycemic variability, justifying rigorous monitoring and management.[13]

With regard to fluid replacement, despite capillary leak and significant fluid, blood, and protein loss observed in patients undergoing CRS and HIPEC, liberal administration of crystalloids may exacerbate interstitial edema. This, in turn, can negatively affect vital organs and intestinal anastomoses, increasing the risk of fistula formation. Therefore, crystalloid infusion should be guided by hemodynamic parameters and individualized for each patient.[14]

Early extubation is encouraged in ERAS protocols, as it facilitates early ambulation, reduces the need for prolonged sedation, and contributes to the rapid return of intestinal function and overall recovery. The presence of an epidural catheter and the infusion of local anesthetics reduce the need for opioids during the intraoperative and immediate postoperative phases, supporting early extubation.[10]

For postoperative analgesia, thoracic epidural analgesia (TEA) is considered the gold standard following extensive laparotomies. It helps restore intestinal function, supports anastomotic integrity, and reduces pulmonary complications. The combination of low concentrations of local anesthetics with a short-acting opioid appears to be the most effective strategy to optimize analgesia while minimizing the risk of motor block and sympathetic block–induced hypotension.[15]

CONCLUSION

CRS combined with HIPEC produces physiological and potentially pathological changes with important implications for anesthetic care, making it challenging and requiring special attention. Evidence-based protocols and recommendations, such as ERAS, are timely and represent a crucial advancement in

the evolution of perioperative management for patients affected by malignant peritoneal surface neoplasms.

REFERENCES

1. van Driel WJ, Koole SN, Sikorska K, et al. Hyperthermic Intraperitoneal Chemotherapy in Ovarian Cancer. N Engl J Med. 2018 Jan 18;378(3):230-240.

2. Verwaal VJ, Bruin S, Boot H, van Slooten G, van Tinteren H. 8-year follow-up of randomized trial: cytoreduction and hyperthermic intraperitoneal chemotherapy versus systemic chemotherapy in patients with peritoneal carcinomatosis of colorectal cancer. Ann Surg Oncol. 2008 Sep;15(9):2426-32.

3. Verwaal VJ, van Tinteren H, Ruth SV, Zoetmulder FA. Toxicity of cytoreductive surgery and hyperthermic intra-peritoneal chemotherapy. J Surg Oncol. 2004 Feb;85(2):61-7.

4. Ben Aziz M, Di Napoli R. Citorredução (CRS) e Quimioterapia Intraperitoneal Hipertérmica (HIPEC) [Atualizado em 31 de julho de 2023]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; Janeiro 2025.
5. de Bree E, Tsiftsis DD. Principles of perioperative intraperitoneal chemotherapy for peritoneal carcinomatosis. Recent Results Cancer Res. 2007;169:39-51.

6. Alyami M, Kim BJ, Villeneuve L, Vaudoyer D, Képénékian V, Bakrin N, Gilly FN, Cotte E, Glehen O, Passot G. Ninety-day post-operative morbidity and mortality using the National Cancer Institute's common terminology criteria for adverse events better describe post-operative outcome after cytoreductive surgery and hyperthermic intraperitoneal chemotherapy. Int J Hyperthermia. 2018 Aug;34(5):532-537.

7. Coccolini F, Gheza F, Lotti M, Virzì S, Iusco D, Ghermandi C, Melotti R, Baiocchi G, Giulini SM, Ansaloni L, Catena F. Peritoneal carcinomatosis. World J Gastroenterol. 2013 Nov 7;19(41):6979-94.

8. Ljungqvist O, Scott M, Fearon KC. Enhanced Recovery After Surgery: A Review. JAMA Surg. 2017 Mar 1;152(3):292-298.

9. Gustafsson UO, Scott MJ, Hubner M, Nygren J, Demartines N, Francis N, Rockall TA, Young-Fadok TM, Hill AG, Soop M, de Boer HD, Urman RD, Chang GJ, Fichera A, Kessler H, Grass F, Whang EE, Fawcett WJ, Carli F, Lobo DN, Rollins KE, Balfour A, Baldini G, Riedel B, Ljungqvist O. Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations: 2018. World J Surg. 2019 Mar;43(3):659-695.

10. Hübner M, Kusamura S, Villeneuve L, Al-Niaimi A, Alyami M, Balonov K, Bell J, Bristow R, Guiral DC, Fagotti A, Falcão LFR, Glehen O, Lambert L, Mack L, Muenster T, Piso P, Pocard M, Rau B, Sgarbura O, Somashekhar SP, Wadhwa A, Altman A, Fawcett W, Veerapong J, Nelson G. Guidelines for Perioperative Care in Cytoreductive Surgery (CRS) with or without hyperthermic IntraPEritoneal chemotherapy (HIPEC): Enhanced recovery after surgery (ERAS®) Society Recommendations - Part I: Preoperative and intraoperative management. Eur J Surg Oncol. 2020 Dec;46(12):2292-2310.

11. Kumar G, Stendall C, Mistry R, Gurusamy K, Walker D. A comparison of total intravenous anaesthesia using propofol with sevoflurane or desflurane in ambulatory surgery: systematic review and meta-analysis. Anaesthesia. 2014 Oct;69(10):1138-50.

12. Lorimier G, Seegers V, Coudert M, Dupoiron D, Thibaudeau E, Pouplin L, Lebrec N, Dubois PY, Dumont F, Guérin-Meyer V, Capitain O, Campone M, Wernert R. Prolonged perioperative thoracic epidural analgesia may improve survival after cytoreductive surgery with hyperthermic intraperitoneal chemotherapy for colorectal peritoneal metastases: A comparative study. Eur J Surg Oncol. 2018 Nov;44(11):1824-1831.

13. Mendonça FT, Guimarães MM, de Matos SH, Dusi RG. Anesthetic management of Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy (CRS/HIPEC): The importance of hydro-electrolytic and acid-basic control. Int J Surg Case Rep. 2017;38:1-4.

14. Colantonio L, Claroni C, Fabrizi L, Marcelli ME, Sofra M, Giannarelli D, Garofalo A, Forastiere E. A randomized trial of goal directed vs. standard fluid therapy in cytoreductive surgery with hyperthermic intraperitoneal chemotherapy. J Gastrointest Surg. 2015 Apr;19(4):722-9.

15. Feldheiser A, Aziz O, Baldini G, Cox BP, Fearon KC, Feldman LS, Gan TJ, Kennedy RH, Ljungqvist O, Lobo DN, Miller T, Radtke FF, Ruiz Garces T, Schricker T, Scott MJ, Thacker JK, Ytrebø LM, Carli F. Enhanced Recovery After Surgery (ERAS) for gastrointestinal surgery, part 2: consensus statement for anaesthesia practice. Acta Anaesthesiol Scand. 2016 Mar;60(3):289-334.

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