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Editorial

Anesthesia Management in Cytoreductive Surgery with Hyperthermic Intraperitoneal Chemotherapy

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Peritoneal carcinomatosis (PC) is a condition wherein advanced stage gastrointestinal or gynecologic carcinomas spread in the peritoneum and it has been reported as a fatal condition [1]. Reportedly, cytoreductive surgery (CRS) with hyperthermic intraperitoneal chemotherapy (HIPEC) is currently among the most frequently preferred treatment methods in patients with PC [1,2].

With CRS, surgeons aim to macroscopically remove tumor, whereas HIPEC is performed for destruction of the tumor tissue at temperatures between 42 - 43°C. Another advantage of HIPEC is the effective delivery of local chemotherapy into the peritoneal cavity, while reducing systemic side effects [1,3].

CRS with HIPEC is currently the preferred method of treating patients with PC owing to its favorable safety profile, low mortality rate, and better management of cases during surgery. Although HIPEC has numerous advantages, it also poses certain difficulties for both surgeons and anesthesiologists. The challenges in the management of anesthesia in these cases include extensive surgical incision, long surgical procedures, and intensive fluid loss [4].

Despite the advances in surgical and anesthetic methods in recent years, hemodynamic disturbances, coagulation, nutritional problems, and respiratory changes are frequently observed post-surgical symptoms. The management of anesthesia is problematic even in young patients who undergo this procedure [5]. Thus, it is imperative to understand the physiopathological processes in patients undergoing this procedure.

Intensive fluid loss occurs during CRS due to large peritoneal surface and acid drainage. Hypothermia, which may occur due to large abdominal incision and extensive debulking, should be prevented using heating pads and covers and the infusion of warm fluids [5,6].

A study of 78 patients was conducted in 2008 by Schmidt., *et al*. who emphasized that intraoperative liquid turnover should be 6 - 8 $ml.kg^{-1}.h^{-1}$. They also reported that blood products, crystalloids, and colloids must be made available in the preoperative period to prevent side effects because of poor blood circulation and maintain normovolemic state and hemodynamic stability in patients undergoing CRS with HIPEC [5].

Tsiftsis., *et al*. in 1999, reported the use of closed abdomen method for HIPEC [7]. However, in closed procedures, shift of the diaphragm into the thoracic cavity and secondary decrease in functional residual capacity and increase in airway pressure may occur while filling the abdomen with saline solution. Decrease in the oxygenation ratio can lead to a sudden rise in the central venous pressure [5].

It is well established that even a small increase in the intraabdominal pressure affects cardiac output by decreasing abdominal blood volume, increasing vascular resistance, and decreasing venous return [8].

The stability of blood volume plays a critical role in providing systemic and regional perfusion. Moreover, hemodynamic stability is crucial in preventing complications such as acute kidney failure. The chief purpose of the anesthesia during HIPEC should be providing adequate fluid therapy [5].

Moreover, an increase in body temperature may occur due to the intraperitoneal administration of hyperthermic solution throughout HIPEC. This may cause metabolic acidosis and an increase in arterial lactate levels. Care must be taken that in these cases for correlation of maximum esophageal temperature with systemic oxygen demand [5,9].

The body responds to heat stress by dilating peripheral vascular network. The heart rate increases with decrease in peripheral vascular resistance. This hyperdynamic circulation usually recovers on completion of HIPEC, but this condition persists very rarely [9,10].

The use of additional hemodynamic monitoring methods is not recommended, since metabolic acidosis caused by increased lactate levels is mild and temporary [5].

Blood loss and bleeding tendency in these types of major surgical operations are among the most prominent complications. Large volume shift and protein loss due to high fluid turnover associated with hyperthermic chemotherapy are considered to be the underlying causes of the bleeding tendency. The workup of patients in these cases should include increased INR values, decreased AT III values, prolonged aPTT, and decreased platelet count [5].

The management of cases after HIPEC is also crucial. Fluid loss from the abdominal drainage catheter during the first 72 hours is frequently observed. It must be kept in mind that there may be an associated decrease in albumin values [5,7,9].

Epidural anesthesia can be used for managing intra and postoperative pain in such surgical interventions. Decreased opioid use during surgery and the decreased need for ventilator support in the postoperative period are among the reported advantages of epidural anesthesia [11].

In conclusion, the following should be kept in mind in the management of anesthesia during CRS with HIPEC:

- Fluid, blood, and protein loss
- Systemic hyperthermia
- Increased metabolic rate

The responsibility of the anesthesiologist here includes the maintenance of circulatory volume. In addition, the use of epidural analgesia decreases the requirement for opioid use and postoperative ventilator support.

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