Case Report

Perioperative concerns and management of pressurised intraperitoneal aerosolised chemotherapy: Report of two cases

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ABSTRACT

Pressurised intraperitoneal aerosolised chemotherapy (PIPAC) is a new, mostly supportive approach to help patients with advanced peritoneal metastasis to increase the lifespan. It carries occupational hazards to health-care workers and especially anaesthesiologist during the procedure. The aerosolised chemotherapy can also cause chemical peritonitis and organ dysfunction in the perioperative period. In this case report, we present the report of two cases and discuss the perioperative concerns and management related to PIPAC.

Key words: Aerosols, chemotherapy, occupational, palliative

INTRODUCTION

Peritoneal metastases are common in advanced gastrointestinal and gynaecological malignancies. Pressurised intraperitoneal aerosolised chemotherapy (PIPAC) is an approach to help control the symptoms and extend the lifespan of patients with advanced peritoneal metastases when surgery and other regimens have failed. It involves delivering chemotherapeutic drugs into the peritoneal cavity as a pressurised normothermic aerosol. The anaesthetic considerations in PIPAC are unique and take into consideration the advanced stage of the disease with associated nutritional and organ system impairments, the chances of chemical peritonitis and the use of aerosolised chemotherapeutic drugs that pose occupational hazards for the operating room (OR) personnel.

CASE REPORTS

The first case was a 56-year-old male, the American Society of Anaesthesiologist (ASA) Class I, known case of carcinoma caecum, previously underwent right hemicolectomy. He received eight cycles of adjuvant chemotherapy with capecitabine and oxaliplatin with last dose 5 months back. The post-chemotherapy positron emission tomography-computed tomography (CT) showed multiple peritoneal deposits with moderate ascites.

On pre-operative evaluation, patient's Nutritional Risk score (NRS) was 2 for which a high-calorie high-protein diet was started to optimise his general condition and improve post-operative outcomes. Baseline complete blood counts, serum electrolytes, renal and liver function tests, coagulation studies and C-reactive protein (CRP) level, Electrocardiography

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and two-dimensional (2D) echocardiography were within the normal limits, except for a serum albumin level of 2.9 g/dl.

The second case was a 72-year-old female, ASA 2 and a known case of pseudomyxoma peritonei who had previously undergone laparoscopic cholecystectomy and appendectomy. She presented with abdominal pain, distension and bloating for four months. CT scan revealed a large complex cystic pelvic mass and metastatic peritoneal disease. Colonoscopy revealed an extrinsic compression of the rectum with luminal narrowing.

A high-calorie high-protein diet was initiated as the patient had an NRS score of 2. Her physical effort tolerance was <4 metabolic equivalents. 2D echocardiography showed mild pulmonary hypertension. The rest of the investigations were within the normal limits.

Written informed consents were taken. The patients were given clear fluids up to 2 h before surgery as per enhanced recovery after surgery guidelines, and thromboprophylaxis was given. In the OR, electrocardiography, non-invasive blood pressure, pulse oximetry, end tidal CO2 and temperature were monitored. General anaesthesia was induced with intravenous (IV) fentanyl (2 μg/kg) and IV propofol (2 mg/kg). Tracheal intubation was facilitated with IV vecuronium (0.1 mg/kg) and appropriately sized cuffed endotracheal tube was secured. The radial artery was cannulated for invasive arterial blood pressure monitoring and arterial blood gas analysis. Anaesthesia was maintained with sevoflurane in oxygen and air.

All the OR personnel, including surgeons, anaesthesiologist and nurses wore the N95 mask. During pneumoperitoneum, controlled ventilation was adjusted to maintain end-tidal CO_2 at approximately 35 mm Hg. The procedure lasted for 30 min, and total duration of anaesthesia was around 60 min in both patients. During the PIPAC, all the staff left the OR. The anaesthesiologist monitored patient's vital parameters remotely from the glass window.

The technique of PIPAC makes its anaesthesia management unique. A CO_2 pneumoperitoneum of 12–15 mmHg at 37° is created, and two trocars are inserted into the abdominal cavity. Peritoneal biopsies are taken, and the peritoneal carcinomatosis index score is determined based on lesion size and distribution. An aerosoliser is connected to a high-pressure injector and inserted into the abdomen through a trocar. A pressurised aerosol containing the chemotherapeutic drug (for ovarian, gastric and hepatobiliary-pancreatic cancers doxorubicin 1.5 mg/m^2 body surface area (BSA) in a 50 ml NaCl 0.9% solution followed by cisplatin 7.5 mg/m^2 BSA in a 150 ml NaCl 0.9% solution and for colorectal and appendiceal cancers, oxaliplatin 92 mg/m^2 BSA) is applied. The therapeutic capnoperitoneum is then maintained for 30 min at 37°C. After the procedure, the residual fumes are exsufflated through a special filter, and the incision is closed.[1] PIPAC provides targeted delivery of a high dose of chemotherapeutic agent to different regions of the peritoneum and causes fewer adverse effects than intravenous administration.

Both patients remained haemodynamically stable throughout the perioperative period. The tracheas were extubated on the table. The patients were shifted to post-anaesthesia care unit and discharged to the ward on the 1st post-operative day. In both patients, complete blood count, renal function test, liver function lest and CRP test were done on the post-operative days 1, 2, and 3. CRP rose from 4.63–22.7 mg/dL in the first case and from 3.87–8.91 mg/dL in the second, on the 2nd post-operative day. All other investigations were within the normal limits. Patients were discharged on the 3rd post-operative day.

DISCUSSION

For abdominal cancers with peritoneal deposits or cancers confined in the peritoneal cavity, intraperitoneal chemotherapy is an established technique of cure or supportive care.[2] For small peritoneal disease nodules, intraperitoneal chemotherapy is beneficial because penetration is good.[3] For treating larger nodules and high-volume disease, complete cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) was reported to be better.[4] CRS-HIPEC is a major procedure with a high risk of perioperative morbidity and mortality.[,5] Patients who cannot tolerate CRS-HIPEC or who have very high-volume peritoneal disease, PIPAC is an alternative palliative procedure.

However, since the chemotherapeutic agents are aerosolised, PIPAC poses an increased risk of exposure to the OR personnel. Occupational exposures to chemotherapy drugs may occur through inhalation,

skin contact, skin absorption, ingestion or injection. Inhalation and skin contact are the most likely routes of exposure. The adverse effects of these agents include hair loss, headaches, acute irritation, hypersensitivity, increased foetal loss, congenital malformations, low birthweight, infertility and a significantly increased risk of leukaemia.[6] Cisplatin can provoke anaphylactic reaction, and it irritates the eyes and skin. It irritates airways and has a cumulative toxic effect on kidney, bone marrow and the inner ear and is probably carcinogenic to humans. Doxorubicin is hazardous to human health by provoking mucosal inflammation, leucopenia and dilated cardiomyopathy. In addition, it induces DNA mutation and is carcinogenic to humans.[7]

To prevent exposure of the OR team, the following safety measures should be implemented. First, the PIPAC procedure should be remote-controlled, and nobody remains in the OR during the application. Second, zero flow of CO_2 should be ensured so that the system remains airtight and no leaks occur. Third, the procedure should be performed in an OR equipped with laminar airflow. Finally, at the end of the procedure, the chemotherapy aerosol should be exhausted into the hospital's air-waste system.

Precautions should be taken by the OR team to prevent exposure. The surgical team should wear special chemotherapy gloves (double gloving), protective glasses and disposable gowns made of polyethylene-coated polypropylene to protect against accidental leaks. All present OR staff should wear N95 masks to prevent inhalation of aerosolised chemotherapeutic drugs. When these masks are sealed tightly around the mouth and nose, they block 95% of particles 0.3 micrometres or larger in diameter. Remote monitoring should be employed during the application. The safest option for remote monitoring is to have both the monitors and the anaesthetist outside the OR where he/she can see the monitor and can hear the alarms. Another option is that the monitors are inside the room with the anaesthetist outside. The patient and the monitors can be viewed through a window or by using a television camera. A drawback of this method is that monitor sounds and alarm signals may not be heard well by the attendant.

In general, PIPAC is very well tolerated, and the post-operative complications of PIPAC are limited compared to traditional chemotherapy. Since only approximately 10% of the chemotherapy drug dose is given, PIPAC has good tolerability as it does not induce significant renal toxicity nor gastrointestinal symptoms as compared to traditional chemotherapy techniques.[8] However, PIPAC can induce transient low-grade liver toxicity in about 25% patients in ovarian cancer.[8,9]

One common finding is an elevation of CRP levels as a sign of chemical peritonitis. The systemic inflammatory response to the chemical peritonitis generally causes milder symptoms. Our patients had a similar elevation in CRP level post-procedure. However, it was self-limiting, and the patients had no complications.

In conclusion, PIPAC is a well-tolerated procedure, but due care should be taken to protect health-care professionals during procedure and modern OR with the proper scavenging system should be used.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Girshally R, Demtröder C, Albayrak N, Zieren J, Tempfer C, Reymond MA, *et al.* Pressurized intraperitoneal aerosol chemotherapy (PIPAC) as a neoadjuvant therapy before cytoreductive surgery and hyperthermic intraperitoneal chemotherapy. World J Surg Oncol 2016;14:253.
2. Ceelen WP, Flessner MF. Intraperitoneal therapy for peritoneal tumors: Biophysics and clinical evidence. Nat Rev Clin Oncol 2010;7:108-15.
3. Matharu G, Tucker O, Alderson D. Systematic review of intraperitoneal chemotherapy for gastric cancer. Br J Surg 2011;98:1225-35.
4. Macrì A, Fortugno A, Saladino E. Rationale and techniques of cytoreductive surgery and peritoneal chemohyperthermia. World J Gastrointest Oncol 2011;3:169-74.
5. Gill RS, Al-Adra DP, Nagendran J, Campbell S, Shi X, Haase E, *et al.* Treatment of gastric cancer with peritoneal carcinomatosis by cytoreductive surgery and HIPEC: A systematic review of survival, mortality, and morbidity. J Surg Oncol 2011;104:692-8.

6. Polovich M. Minimizing occupational exposure to antineoplastic agents. J Infus Nurs 2016;39:307-13.
7. Solass W, Giger-Pabst U, Zieren J, Reymond MA. Pressurized intraperitoneal aerosol chemotherapy (PIPAC): Occupational health and safety aspects. Ann Surg Oncol 2013;20:3504-11.
8. Nadiradze G, Giger-Pabst U, Zieren J, Strumberg D, Solass W, Reymond MA, *et al.* Pressurized intraperitoneal aerosol chemotherapy (PIPAC) with low-dose cisplatin and doxorubicin in gastric peritoneal metastasis. J Gastrointest Surg 2016;20:367-73.
9. Demtröder C, Solass W, Zieren J, Strumberg D, Giger-Pabst U, Reymond MA, *et al.* Pressurized intraperitoneal aerosol chemotherapy with oxaliplatin in colorectal peritoneal metastasis. Colorectal Dis 2016;18:364-71.