

# Successful Resuscitation After Carbon Dioxide Embolism During Laparoscopic Cholecystectomy

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## Abstract

Laparoscopic surgery is preferred since it shortens stay in hospital, lessens postoperative pain and complications, and because of the cosmetic advantages. Laparoscopic cholecystectomy surgery was planned for a 27 year old female patient, who was 110 kg and 167 cm tall. During the preoperative physical examination nothing was determined other than the morbid obesity (BMI:39). CO<sub>2</sub> insufflation was started by using a Veress needle under the belly. When desaturation and frequent ventricular early fibrillation developed, CO<sub>2</sub> insufflation was immediately stopped. Since the arrhythmias of the patient continued, 100 mg of lidocaine i.v. was applied and 100% of O<sub>2</sub> was started. The table was positioned as trendelenburg and it was turned to left. Bradycardia and cardiac arrest developed in the patient whose SpO<sub>2</sub> was measured at 65% when desaturation increased. Immediately 1 mg of atropin and 1 mg of adrenalin i.v. was given and cardiopulmonary resuscitation and external cardiac massage was applied. After giving totally 4 mg of adrenalin in a number of doses, sinus tachycardia developed in the approximately 20th minute of the resuscitation. The patient was extubated and taken to intensive care nearly 60 minutes after the induction. In the abdominal USG done during the postoperative early phase, no free liquid was determined in the abdomen. Postoperative blood counts were stabilized. The patient was discharged the next day, and 3 months later, a nonproblematic laparoscopic cholecystectomy surgery was done.

## INTRODUCTION

Minimal invasive surgery practices, which are done together with laparoscopic method, have been frequently used as a result of the technical developments and increasing safety. Laparoscopic surgery is preferred since it shortens stay in hospital, lessens postoperative pain and complications, and because of the cosmetic advantages (1,2). However, serious complications can be seen during and after the surgery. In this paper it was aimed to present a young and healthy case that underwent cardiopulmonary resuscitation after she suffered cardiac arrest because of carbon dioxide embolism during laparoscopic cholecystectomy.

## CASE REPORT

Laparoscopic cholecystectomy surgery was planned for a 27 year old female patient, who was 110 kg and 167cm tall. Through the anamnesis, it was learned that she had a baby 3 months before by normal birth and during the preoperative physical examination, nothing was determined other than the morbid obesity (BMI:39). Routine preoperative blood tests, ECG, and the pulmonary graphy were evaluated normally, and no systemic disease or drug treatment was determined in the history of the patient. After routine preoperative

premedication, the patient was taken to the operation theatre and ECG, noninvasive arterial pressure and pulse oxymetry monitorization was performed. HR of the patient who was taken to the surgery table was 84 beat/min , BP was 119/71 mmHg, and , SpO<sub>2</sub> was 98%. Following the preoxygenation, 2 mg/kg propofol + 75 µg Fentanyl + 0.5 mg/kg atracurium besilate iv. were given for the anesthesia induction. The patient was intubated using a 7.5 size endotracheal tube after adequate muscle relaxing. Maintenance of the anesthesia was provided by sevoflurane 2-3% + 50% O<sub>2</sub> + 50% air. After routine sterile treatment and covering, the surgery started. For the surgery, CO<sub>2</sub> insufflation was started by using a Veress needle under the belly. When desaturation and frequent ventricular early fibrillation developed, CO<sub>2</sub> insufflation was immediately stopped. Since the arrhythmias of the patient continued, 100 mg of lidocaine i.v. was applied and 100% of O<sub>2</sub> was started. The table was positioned as trendelenburg and it was turned to left. Bradycardia and cardiac arrest developed in the patient whose SpO<sub>2</sub> was measured at 65% when desaturation increased. Immediately 1 mg of atropin and 1 mg of adrenalin i.v. was given and cardiopulmonary resuscitation and external cardiac massage was started. After giving

totally 4 mg of adrenalin in a number of doses, sinus tachycardia developed in the approximately 20<sup>th</sup> minute of the resuscitation. HR was 135 /min, BP was 138/81 mmHg, SpO<sub>2</sub> was 80%. In the 40<sup>th</sup> minute of resuscitation the patient regained consciousness. However muscle power was not regained sufficiently so propofol sedation was applied and the effect of the muscle relaxant was waited to end. The patient was extubated and taken to intensive care nearly 60 minutes after the induction. In the abdominal USG done during the postoperative early phase, no free liquid was determined in the abdomen. Postoperative blood counts were stabilized. The patient was discharged the next day, and 3 months later, a nonproblematic laparoscopic cholecystectomy surgery was done.

### DISCUSSION

Laparoscopic surgery has some advantages such as being a less invasive procedure and providing a lower risk for postoperative complication (3). In addition, advancements in laparoscopic surgery have resulted in decreased length of hospitalization, reduced postoperative pain, and better cosmesis following general surgical procedures (4).

Gas embolism may occur not only during laparoscopic surgery, but also during open surgery such as major liver resections, neurosurgery, vascular or cardiac surgery. Besides, the vein internal pressure becomes lower than the external pressure when carbon dioxide is inflated into the peritoneal cavity, and gas embolism may occur because of the damage formed on the abdominal wall or operation area (5).

Clinically apparent carbon dioxide embolism is a rare complication of laparoscopic surgery (nearly 0.0014-0.6 % of laparoscopies) but it has a high mortality rate of 28 % (6,7).

The major cause leading to gas emboli is the misplacement of the Veress needle directly into a vein or parenchymal organ, but smaller amounts of gas may also enter circulation through an opening in any injured vessel, either on the abdominal wall or at the operative site. Therefore it is not surprising that 60 % of the symptomatic cases occur during initial CO<sub>2</sub> insufflations (6,8).

Carbon dioxide embolisation must always be suspected during laparoscopic surgery whenever there is sudden deterioration of the haemodynamic status associated with decreased end-tidal carbon dioxide levels and chest compliance (4,9).

Slow infusion of air is known as occlude pulmonary circulation. This may be compensated by an increase in cardiac output but when it fails, it leads to hypotension. A large air bolus can produce a “gas lock” meaning complete mechanical obstruction and ineffective contraction of the right heart, causing acute hypotension or even cardiac arrest (10).

In the presented case the symptoms started during carbondioxide insufflation in the form of desaturation and arrhythmia and following that, cardiac arrest developed.

Clinically, gas embolism can present as profound hypotension, dyspnea, cyanosis and arrhythmias or asystole. A mill-wheel murmur can be auscultated. There is an initial sudden increase in the end-tidal O<sub>2</sub> concentration, which decreases later due to cardiovascular collapse. If a gas embolism is suspected, a series of measures have to be immediately taken including deflation of pneumoperitoneum, placement of the patient in Durant's position (left lateral decubitus with head down position) which allows the gas to rise into the pulmonary artery. The Trendelenburg position is also sufficient as it has the same effect. Hyperventilation and administration of 100 % of oxygen helps rapid carbon dioxide elimination. Aggressive cardiopulmonary resuscitation and a central venous catheter should be placed to aspirate the gas. Hyperbaric oxygen is less useful than for air embolisms because carbon dioxide is more soluble and there is a high pressure gradient between the blood and carbon dioxide bubbles (over 600 mmHg) which encourages reabsorption (11,12,13,14).

In the presented case, pulmonary gas embolism was suspected and resuscitation commenced immediately. The patient was returned to a head-down left-lateral position, given an external cardiac massage and ventilation with 100% of oxygen.

As a result, it can be stated that while laparoscopic surgery has some advantages such as being a less invasive procedure, providing a lower risk for postoperative complication, decreased length of hospitalization and reduced postoperative pain, it may lead to serious complications such as gas embolism. Therefore careful monitorisation and early diagnosis are important in successful resuscitation.

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