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Case-Report

Management of Laparoscopic Surgery in Intraoperative Subcutaneous Emphysema

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ABSTRACT

Background: Over the past 50 years, laparoscopy has evolved from a limited gynecological surgical procedure that is only used for diagnosis and tubal ligation to become the main surgical tool used for many gynecological indications. Many studies have shown that laparoscopy is safer, more affordable, and has a shorter recovery time than laparotomy. This study aimed to report the management of laparoscopic surgery in intraoperative subcutaneous emphysema.

Case Report: The subject of the study was a 37-year-old woman with adenomyosis and chocolate cyst of sinistra with a surgery plan for resection of adenomyosis and per laparoscopic cystectomy with the physical status of the ASA II Plan GAET. The surgery was carried out on October 15, 2018, with surgery for 5 hours. At the intraoperative, subcutaneous emphysema was found from the diaphragm to the thorax. In this condition, the peritoneal insufflation was reduced to 10-12 mmHg. The head down was returned to a position that made it easier for the patient's condition to reduce the occurrence of decreased lung compliance. The patient's postoperative condition was good, the hemodynamic was stable, her breath was spontaneous, and the saturation was 99% with oxygen supplementation via Nasal Kanul 3 lpm. The subcutaneous emphysema gradually disappeared 24 hours postoperatively.

Conclusion: Subcutaneous emphysema may occur in the laparoscopic procedures. The close monitoring during surgery and the expertise of the anesthesiologist in diagnosing and intervening is crucial in controlling this condition.

Keywords: subcutaneous emphysema; laparoscopy; intraoperative intervention

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BACKGROUND

Over the past 50 years, laparoscopy has evolved from a limited gynecological surgical procedure that is only used for diagnosis and tubal ligation to become the main surgical tool used for many gynecological indications. Nowadays, laparoscopy is one of the most common surgical procedures performed in the world (Ferreira et al., 2018; Onoh et al., 2018).

Almost all gynecological procedures, such as ectopic pregnancy removal, endometriosis treatment, ovarian cystectomy, and hysterectomy use laparoscopic procedures. Many studies have shown that laparoscopy is safer, more affordable, and has a shorter recovery time than laparotomy. The benefits of the laparoscopic approach to other procedures, including myomectomy, sacral colpopexy, staging, and treatment of gynecological cancers increasingly spread (Srivastava and Niranjan, 2010; Hayden and Cowman, 2011; Bajwa and Kulshrestha, 2016; Ferreira et al., 2018; Onoh) et al., 2018).

The procedure of laparoscopy was first conducted on dogs in the early 1900s by Dr. Georg Kelling, a German surgeon, who called it as koelioskopie. When experimenting with

the use of pneumoperitoneum air to stop intra-abdominal hemorrhage, he introduced a cystoscope to the stomach to see the effect of increased pressure on the abdominal organs (Kim et al., 2013; Tiwari et al., 2013).

In the early 20th century, the diagnostic laparoscopy was performed by several general surgeons as a substitute for diagnostic laparotomy. However, it had a substantial complication level. From the 1920s to the 1930s, the proponents of the procedure continued to develop better laparoscopic equipment, such as pyramidal trocar for port and lens recognition with a view angle wider than 90° provided by the cystoscope. During this period, Dr. Janos Veress, a Hungarian internist, developed a spring-loaded needle with an inner stylet that automatically turned a sharp tip into a round-tip. The Veress needle is still using nowadays to create a pneumoperitoneum (Kim et al., 2013; Tiwari et al., 2013).

The use of laparoscopy has revolutionized the field of surgery by reducing morbidity with early recovery. Laparoscopic procedures have traditionally been performed under the general anesthesia (GA) due to respiratory changes caused by pneumoperitoneum, which are an integral part of laparoscopy (Srivastava and Niranjan, 2010; Hayden and Cowman, 2011; Bajwa and Kulshrestha, 2016).

The precise ventilation control under controlled conditions at GA has proven to be ideal for the procedure. However, the use of regional anesthesia (RA) recently has emerged as an alternative way for laparoscopy. Various reports in the literature showed the safety of using spinal-epidural, spinal, and epidural combination anesthesia in the laparoscopic procedures (Lennox et al., 2002; Zundert et al., 2006). The benefits of using RA were in the prevention of airway manipulation, the patients who woke up and breathe directly at the intraoperative, a minimal possibility to have nausea and vomiting, the effective postoperative analgesia, and the early ambulation and recovery (Gharaibeh, 1998; Ng and Smith, 2004). However, RA could be associated with several side effects such as the need for higher sensory levels, more severe hypotension, shoulder pain due to diaphragmatic irritation, and respiratory embarrassment caused by pneumoperitoneum. Further study needs to be conducted to establish the excellence of RA over GA for its global use in different patient populations (Sharma et al., 2007; Srivastava and Niranjan, 2010; Hayden and Cowman, 2011; Bajwa and Kulshrestha, 2016).

The gradual removal process of laparoscopy to put more complicated surgical procedures created the modification of existing anesthetic techniques. Various effects of pneumoperitoneum induction, an integral part of laparoscopy, can cause respiratory and cardiovascular changes. Therefore, it should be managed using GA. Since the implementation of laparoscopy conducted in various pediatric operations, better anesthetic techniques are needed to allow early recovery and ambulation. The evolution of anesthetic drugs on a scale that is scientifically and clinically relevant has led to the innovations and ideas for newer but safer techniques. The development in anesthesiology has been made in many fields besides scales that clinically relevant (Srivastava and Niranjan, 2010; Hayden and Cowman, 2011; Bajwa and Kulshrestha, 2016).

Recently, RA has been documented to have equally good results in laparoscopic surgery. This review has been carried out to compare the advantages and disadvantages of using RA vs GA in laparoscopic surgery (Lennox et al., 2002; Zundert et al., 2006).

CASE PRESENTATION

On October 13, 2018, a 37-year-old woman with the main complaint of left abdominal pain came. The patient said that she felt pain in her left abdomen for a year. Nausea and vomiting (-). Coughs and colds (-). She had menstruation once a month. The patient had a history of hypertension and diabetes mellitus since 2017. Diabetes mellitus was controlled. The insulin was 10 IU in the morning and 8 IU at night.

The patient's condition is fully conscious, with GCS E4V5M6. The patient had a blood pressure of 130/80 mmHg, pulse 88 x/min, respiration rate 16x/min, a body temperature of 36.40C, and 100% oxygen saturation with 3 lpm nasal cannula oxygen. The patient had a bodyweight of 75 kg, a height of 154 cm, and a Body Mass Index of 31.65.

The airway was free, nasal patency (+/+), septal deviation (-/-), open mouth >3 fingers, the mallampati was 3, the teeth were in the normal limits, the neck motion was free, TMD5 cm. Breathing: the thorax was normochest, symmetrical, right chest development=left, retraction (-/-), breathing muscles (-/-), sonor, vesicular base sound (+/+), additional sounds (-/-), breathing frequency in 20x/minute. Circulation: the heart sounds of I-II was regular, noisy (-). Blood pressure was 130/80mmHg, pulse was 88 x/minute, regular rhythm, enough content, CRT <2 seconds, acral coldness (-/-). Disability: GCS E4V5M6, isochoric pupils with a diameter of 3mm/3mm, light reflexes (+/+).

RESULTS

Based on the thorax examination, there was a sonor percussion throughout the lung field, auscultation sounds a basic sound: vesicular (+/+), additional sounds: RBH (-/-), RBK (-/-), wheezing (-/-). On a single BJ1-2 cardiovascular examination, the rhythm was regular, murmurs (-). On the examination of the palpable abdomen, the result was supple, tenderness (-), the abdominal percussion was tympanic, the auscultation of abdominal bowel sounds was within normal limit. The akral was warm, the edema was not found in all extremities.

Based on the result of the laboratory tests, Hb 13.6, Ht 39, AL 9.1, AT 398, AE 4.56, PT 13.7, APTT 32.5, INR 1,090, GDS 101, Cr 0.5, Ur 26, Na 136, K 4.2, Cl 109, HbsAg NR. ECG The result showed sinus rhythm, HR 92 bpm, and normoaxis. Based on the result of chest X-Ray, there were no abnormalities in the pulmo impression, the cor was invalid. Based on the result of the USG, the VU was quite filled, the shape and the size was dbn, the hypoechoic mass was 4.55x4.52x 3.05cm. It showed that it sustained the chocolate cyst.

Based on the patient's condition, the diagnosis of anesthesia was as follows: a 37-year-old woman with adenomyosis+chocolate cyst of sinistra of pro-resection adenomyosis+per laparoscopic cystectomy with a physical status of ASA II Plan GAET. Furthermore, the patient was prepared for surgery. The preparation were the family was given an explanation of the plan, the procedure of anesthesia and surgery, the possibility of things that might occur during the intervention, the alternative intervention to face the risk of surgery, and the preparation of drugs and tools.

After preparing the pre-surgery, the surgery was begun. The patient entered the operating room on October 15, 2018, at 08.00, the ECG lead was conducted, oxygen saturation, blood pressure, and body temperature measurements. Based on the result, the vital signs of blood pressure was 138/95 mmHg, the heart rate was 84 x/minute, the breathing frequency was 18 x/minute, the temperature was 36.30C, the O2 saturation was 100%, the EKG was sinus rhythm.

The preoxygenation was given to the patient with 8 lpm of pure O2 in the supine position. The patient was given coinduction

with 2 mg of midazolam followed by giving Fentanyl 150 mcg (~2mcg/kg) slowly after 5 minutes. The patient was given 70 mg of Propofol (~1mg/kg) after 3 minutes. After the airway was completely controlled, the muscle relaxant was given. It used 35 mg of Atracrium (0.5 mg/kg). For the anesthesia maintenance, it used sevoflurane as much as 1.5 - 2 vol% and N250% in the administration of intraoperative analgesics as much as 0.5-1 mcg/kgbb/hour, and atracurium at 10-10 mcg/kg/min.

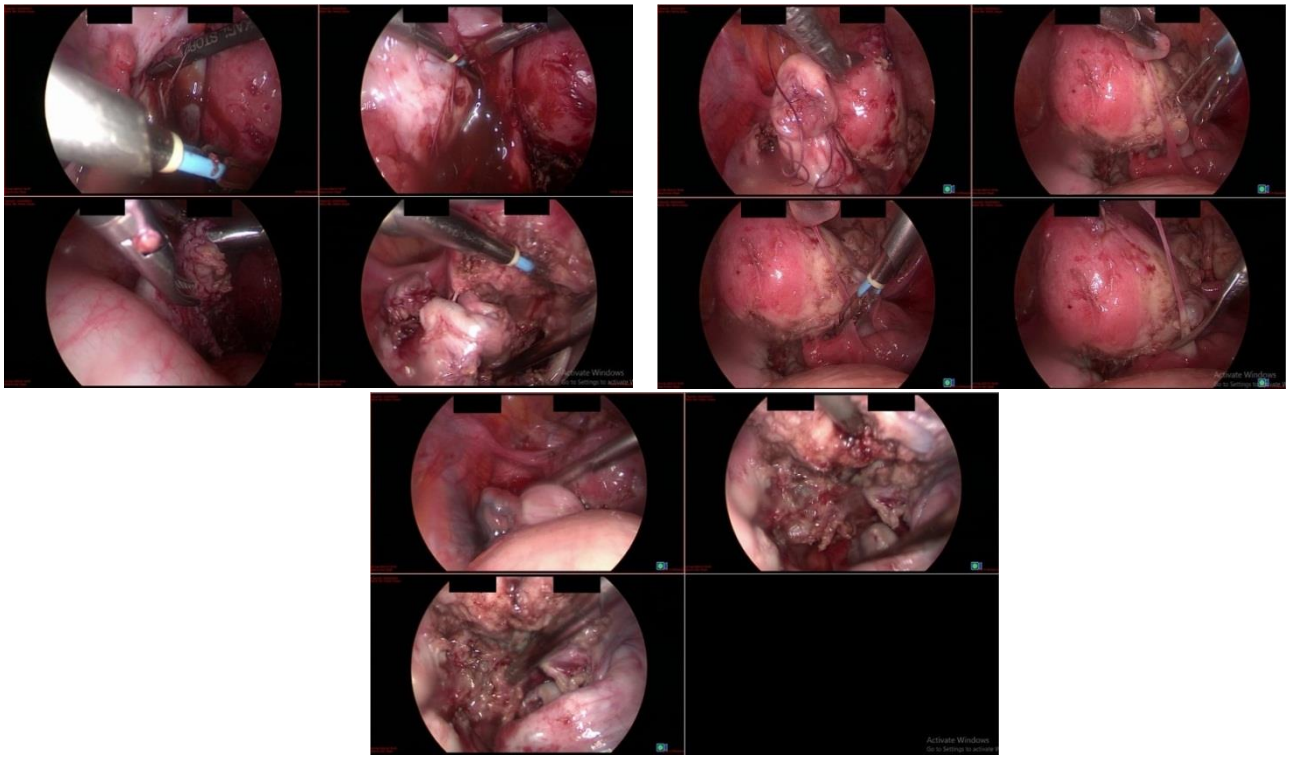

Figure 1. The figures of resection of the adenomyosis and perlaparoscopic cystectomy

Durante operation range of TD was 100-120 mmHg of systolic, 60-80 mmHg of diastolic, 64-135 mmHg of MAP, 78-88 x/min of patient pulse, and 99-100% of O2 saturation. The ETCO2 of the durante operation in the first hour of operation ranged from 30-35 mmHg, using Respiration Control VCV TV as much as 350mL, RR 14x/min, I:E=1:2, PEEP=6. The head down was applied to the patient as much as 5' and the Intraabdominal Pressure Insufflation using CO2 up to 12 mmHg. 2 hours later, the operator asked to increase the CO2 insufflation pressure to 15-20 mmHg and head down that was quite extreme as 30'. In the first 1 minute, the ETCO2 value has not increased. In the second minute, ETCO2 increased dramatically to 45 mmHg, TD 130/90 mmHg, N 88x/minute, SpO2 96%. The Respiration Control Mode was changed by raising the RR by 20x/minute and I:E=1:3 O2:Air bar=3:1. The ETCO2 gradually decreased and remained at 42 mmHg. There was subcutaneous emphysema at the 3rd hour from the diaphragm to the thorax. In this condition, the insufflation was lowered again to 10-12 mmHg. The head down was returned to a position that made it easier for the patient's condition to reduce the occurrence of decreased lung compliance.

Figure 2. The subcutaneous emphysema reached the neck circumference

The subcutaneous emphysema in the thorax expanded to the 4th hour with the condition of ETCO2 has decreased to 35 mmHg from 10.20. It expanded towards the neck circumference. At the 5th hour, ETCO2 decreased quite well, ranging between (30-35 mmHg). The subcutaneous emphysema in the neck circumference gradually decreased and it only lived in the thorax. After surgery, the position was neutralized. The abdominal insufflation was turned off. The ETCO2 returned to the normal range of 30-35 mmHg, followed by a fairly good reduction in the emphysema crepitus.

Figure 3. The subcutaneous emphysema in the neck circumference was reduced

The patient's postoperative condition was good, the hemodynamic was stable, her breath was spontaneous, and the saturation was 99% with oxygen supplementation via Nasal Kanul 3 lpm. The patient was observed in the Recovery Room for 2 hours. During the observation, there was no nausea and vomiting. The intravenous analgesic paracetamol as much as 1 gram/8 hours was given after surgery. Then, the patient was moved to the treatment room.

DISCUSSION

Laparoscopy was the process of inspecting the inside of the abdominal cavity by using an endoscope through minimal access. To get a good visual field in the abdominal cavity, pneumoperitoneum was needed. It was the insufflation of the peritoneal cavity with CO2 gas. This procedure, with the patient's extreme position, had a significant physiological effect. Knowledge and understanding of this were very important for good anesthesia management (Hirose et al., 2018; Aseni et al., 2019).

The use of laparoscopic techniques has been very advanced. It could be prescribed for many procedures. Nowadays, laparoscopy is the most common surgical procedure for outpatients. Laparoscopic surgery is preferred because it is minimally invasive. It is also associated with a faster wound healing process. However, the laparoscopic procedure might be difficult to do to a patient with a poor condition due to these physiological changes. Anesthesia must be conducted carefully and adjusted to the type of surgery and the patient's condition (Gerges et al., 2006; Upadhyay, 2019).

During laparoscopic surgery, there was an unexpected condition: Subcutaneous Emphysema. It might occur due to these conditions. Therefore, the patient's decline becomes an extreme head-down (Trendelenburg position). Besides, the CO2 insulation was quite extreme up to 15-20 mmHg. Another additional factor was also caused by a large amount of adipose tissue (BMI≥32), thus making it difficult for operators to visualize the operating field.

Close monitoring during durante operation and anesthesiologist's expertise in diagnosing and intervening in respiration was crucial in controlling this condition. Therefore, it did not increase its complications (Najia and Mandeep, 2018).

During pneumoperitoneum, ventilation control was adjusted to maintain PETCO2 as much as 30-35 mmHg. It required no more than 15-25% of the increase in one minute ventilation, unless the subcutaneous emphysema occurred. The increased breath frequency was preferred more than the increased tidal volume in patients with Chronic Obstructive Pulmonary Disease (COPD) and in patients with spontaneous pneumothorax or subcutaneous emphysema. It aimed to avoid increasing alveolar inflation and reducing the risk of pneumothorax (Dora, 2002; Means et al., 2004; Carey et al., 2019).

The intra-abdominal pressure must be monitored. It must also be maintained as low as possible to reduce hemodynamic and respiration changes. Besides, it should not exceed 20 mmHg. Relatively, it should be maintained below 12 mmHg. Increased intra-abdominal pressure could be avoided by maintaining the depth of anesthesia. Due to the tendency for an increase in vagus tone directly during laparoscopy, the Atropine must be provided for injection if needed (Gharaibeh, 1998; Hirose et al., 2018; Aseni et al., 2019).

AUTHOR CONTRIBUTION

RTh. Supraptomo and Parada Jiwanggana played a role in conceptualizing the study, determining the methodology, collecting the data, and writing the scripts.

CONSENT FOR PUBLICATION

The parents of the patient provided written informed consents to publish clinical details along with any identifying images. A copy of written consent is available for review by editor-in-chief of this journal.

CONFLICT OF INTEREST

This study did not have any conflict of interest.

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