

Anesthetic experience during a laparoscopic appendectomy in a pregnant patient with isolated cor triatriatum sinister

ABSTRACT

A 39-year-old pregnant patient with acute appendicitis was planned for emergency laparoscopic appendectomy in the second trimester of pregnancy. Preoperative two-dimensional transthoracic echocardiography revealed asymptomatic cor triatriatum sinister (CTS), dividing left atrium into two chambers. There was no associated cardiac anomaly, wall motion abnormality, or pulmonary hypertension. We report the case of a pregnant patient with CTS who uneventfully underwent laparoscopic appendectomy without invasive cardiac monitoring using total intravenous anesthesia.

Key words: Cor triatriatum; laparoscopic surgery; pregnancy; total intravenous anesthesia

Introduction

Cor triatriatum (CT) is defined as the division of either the left (Cor triatriatum sinister, CTS) or right atrium (Cor triatriatum dexter, CTD) into three atrial chambers. The atrium is divided into a true (distal) atrium and an accessory (proximal) atrium by a perforated fibromuscular membrane, and blood flow is exchanged through this structure. CT is a very rare congenital abnormality, comprising 0.4% of congenital heart disease.^[1] CT is frequently associated with other congenital heart diseases such as atrial septal defect, patent foramen ovale, anomalous pulmonary venous return, and tetralogy of Fallot.^[2]

There are several cases in the literature describing patients with uncorrected CT who underwent noncardiac surgery.^[3] However, there was only one laparoscopic case involving an individual with CT.^[4] Herein, we report the case of a

pregnant patient with asymptomatic CTS who underwent laparoscopic appendectomy using total intravenous anesthesia (TIVA).


Case History

A 33-year-old primigravida (height 167 cm, weight 74 kg), at 20 + 4 weeks of gestation was admitted to the emergency department with abdominal pain. She denied any other medical history. However, she experienced intermittent temporal headache once a week at 12 weeks of gestation. CTS was diagnosed incidentally on two-dimensional transthoracic echocardiography (TTE), and no other concomitant cardiac anomalies were observed [Figure 1]. TTE results showed an ejection fraction of 56% without regional wall motion abnormalities and right ventricular systolic pressure of 24 mmHg. Color Doppler imaging showed no signs of blood flow obstruction within the left atrium [Figure 2].

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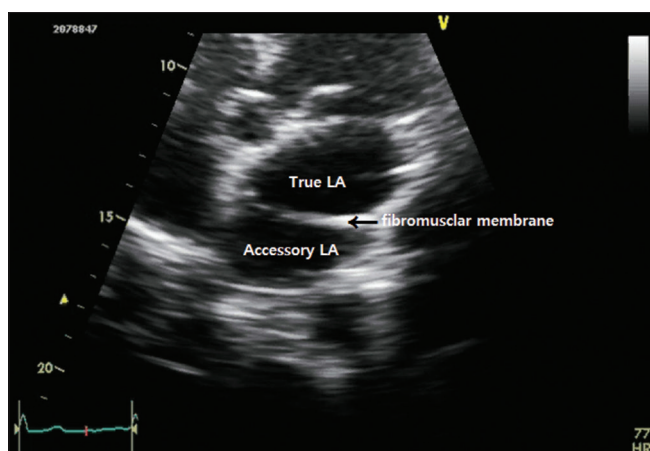


Figure 1: Transthoracic echocardiography showing an abnormal separating membrane in the left atrium. (Arrow: Fibromuscular membrane)

The patient was scheduled for emergency laparoscopic appendectomy with a nil per os (NPO) time of 6 h. In preanesthetic evaluation, EKG showed sinus tachycardia (100 beats/min), and lab profiles (which included electrolytes, kidney function tests, liver function tests, coagulation profile, and complete blood count), and chest X-ray were normal. No premedication was administered.

In the operating room, noninvasive blood pressure (NIBP), SpO₂, heart rate (HR), bispectral index (BIS), and train-of-four ratio (TOF) were monitored, and the left radial artery was cannulated for hemodynamic monitoring prior to the induction of anesthesia. The patient's baseline BP was 130/76 mmHg, HR was 105 beats/min, and body temperature was 38°C. Anesthesia was induced using TIVA with an effect-site concentration of propofol of 4 mcg/mL and remifentanyl 4 ng/mL. The patient was administered rocuronium priming dose of 5 mg IV and 45 mg IV was then administered following the loss of consciousness. We performed rapid sequence intubation using a cuffed 6.5 mm ID tracheal tube. Anesthesia was maintained with propofol 3–5 mcg/mL and remifentanyl 3–5 ng/mL, which was adjusted to a target BIS level of 40–60. Mechanical ventilation was set to a tidal volume of 450 mL, respiratory rate of 14 breaths/min and FiO₂ of 0.5. CO₂ pneumoperitoneum was made at an intra-abdominal pressure (IAP) of 10 mmHg. Trendelenburg and left-tilt position was applied to facilitate the surgical view. During the operation, peak inspiratory pressure (PIP) was maintained at 15–20 mmHg and EtCO₂ was maintained at 32–35 mmHg. Mean arterial pressure (MAP) was maintained at 65–85 mmHg, HR was 80–100 beats/min, SpO₂ was 100%, and TOF was 0–30%. Upon completion of the surgery, neuromuscular block was reversed with pyridostigmine 10 mg IV and glycopyrrolate 0.2 mg IV. After confirmation of complete recovery from neuromuscular blockade, the patient was extubated and transferred to the postanesthesia care

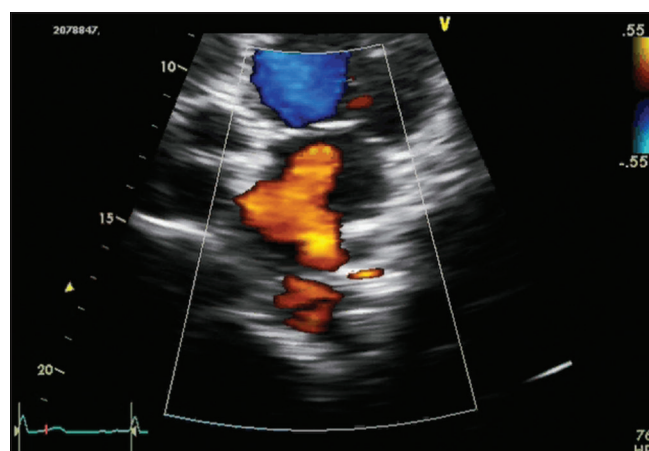


Figure 2: Two-dimensional color flow Doppler image demonstrating no flow obstruction between the true and accessory atrium

unit. No specific complications or hemodynamic instability occurred during the surgery. On the fifth day after surgery, she was discharged with no complications.

Discussion

The physiological effects of CT are directly related to the size and the number of fenestrations between the accessory and the true atrium. If the size or the number of fenestrations is small, obstruction occurs between the proximal and distal atrium, resulting in an increased pressure gradient. Cases of large or large numbers of fenestrations may appear asymptomatic as no pressure gradient builds up. However, symptoms may develop over time as the abnormal fenestrations degenerate, resulting in septal fibrosis, calcification, and narrowing of the orifice.^[5] Moreover, the pressure gradient dilates the proximal chamber, becoming a source of atrial fibrillation, thus increasing the likelihood of systemic embolic events.^[6]

Our patient was diagnosed with isolated CTS of Loeffler's classification group 3.^[7] She did not have pulmonary hypertension (PH) because there were large openings in the membrane of the left atrium without a pressure gradient on color Doppler imaging. Therefore, she experienced no subjective symptoms prior to our diagnosis.

As our patient with CTS underwent laparoscopic surgery while pregnant, it is important to consider the anesthetic management of CTS as well as the effects of physiological changes with respect to both pregnancy and laparoscopic surgery.

To minimize the possibility of neurotoxicity in the developing brain of the foetus in pregnancy, TIVA was chosen in this case rather than inhalation anesthetics.^[8] In addition, TIVA is an

association with a lower incidence of postoperative nausea and vomiting and a lower endocrine stress response than inhalation agents.^[9] TIVA would also offer the advantage in a pregnant patient of maintaining placental flow owing to the reduced stress hormonal response.^[10]

In laparoscopic surgery, hemodynamic changes are mainly affected by the CO₂ pneumoperitoneum. It increases IAP, leading to an increase in MAP.^[11] The diaphragm of a pregnant patient is displaced cephalad as the foetus grows, which leads to a decrease in lung capacity, and functional residual capacity (FRC). These pregnancy-induced changes overlap with the decrease in FRC caused by CO₂ pneumoperitoneum, making the patient more prone to suffer hypoxia. In addition, increased IAP caused by CO₂ pneumoperitoneum can also lower HR, increase MAP and systemic vascular resistance, and decrease placental flow.^[12] To minimize the adverse effects on placental perfusion, IAP greater than 15 mmHg should be avoided during surgery.^[13] An additional concern related to CO₂ pneumoperitoneum is hypercarbia that promotes pulmonary vasoconstriction and increased pulmonary vascular resistance (PVR) exacerbates PH.^[14] Cases of symptomatic CT or coexisting PH can be exacerbated by hypercarbia.

CT requires different anesthetic approaches as physiological changes vary depending on the affected sites. CTS and CTD demonstrate similar symptoms with mitral stenosis and tricuspid stenosis.^[15,16] In CTS, it is important to prevent PH. Blood flow obstruction to the left ventricle increases left atrial pressure and pulmonary arterial pressure (PAP), resulting in tricuspid regurgitation and eventually leading to right heart failure.^[17] Furthermore, tachycardia reduces diastolic inflow to the left ventricle, thus increasing left atrial and PAP leading to pulmonary edema. Therefore, it is important to maintain normal sinus rhythm and sufficient preload, which maximizes blood flow through the proximal and distal atrium and facilitates left ventricular filling pressure. In addition, it is important to maintain adequate afterload while avoiding an increase in PVR to prevent reflex tachycardia. Hypoxia and hypercarbia should be also avoided, as they can raise PVR excessively, which can lead to acute right ventricular failure.^[18]

Another consideration for patients with CT undergoing laparoscopic surgery is the surgical position. The Trendelenburg position increases venous return, right atrial pressure, pulmonary capillary wedge pressure, and PAP, leading to right ventricular failure. Since pregnancy itself can cause hyperdynamic circulation, clinicians should be aware that asymptomatic CTS may become symptomatic following surgery. In this case, positive end-expiratory pressure was

set to zero to reduce the effect of increasing right atrial pressure when changing to a Trendelenburg position. In addition, we requested the surgeon to apply for the minimum Trendelenburg position, maintaining PIP below 20 mmHg.

In this case, transesophageal echocardiography (TEE) was not used owing to insufficient NPO time, but TEE would be the most appropriate monitoring method for evaluating cardiac function and volume status during surgery in patients with CT.

In summary, we report the successful management of a pregnant patient with isolated, asymptomatic CTS who underwent laparoscopic surgery without invasive cardiac monitoring using TIVA. However, pregnant women with asymptomatic CT may develop tachycardia owing to labor pain and hyperdynamic circulatory states at the end of pregnancy, resulting in pulmonary edema and acute cardiac decompensation during the peripartum period. Therefore, it is important to consider these physiological and hemodynamic changes when providing anesthesia to a pregnant patient with CT.

Statement on obtaining the patient consent

The patient was informed that her examination result (including TTE images, lab data) and other clinical information would be reported in the article and this information would only be used for this article work. In addition, the patient was informed of the right to refuse to participate in the article or to withdraw consent at any time. The patient understood that her name would not be published and the authors will make effort not to expose her identity, but anonymity cannot be guaranteed. The authors certify that they have obtained all appropriate patient consent forms.

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Conflicts of interest

There are no conflicts of interest.

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